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Calendars in Mesoamerica and Peru
Native American computations of time

edited by
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and
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INTRODUCTORY NOTE

The papers in this volume have all arisen from the Symposium "Calendars and Chronology" which the editors chaired at the 44th International Congress of Americanists, in Manchester 1982. Between them, these contributions represent or refer to the main current developments in the study of native chronology both Mesoamerican and Peruvian (or Inca). Their approaches include the archeological considerations of site and structure alignments (Urton and Aveni, Ponce de León); the elucidation of native texts both in their original script (Lounsbury and Carlson on the hieroglyphic, and Whittaker and Brotherston on the iconographic writing of Mesoamerica) and as transcribed into the alphabet and related colonial sources (Broda, Zuidema); and enquiry into the practices and science of American Indians living today (Tedlock, Tichy).

The problems addressed are chiefly those of ascertaining the sources of perceived periodicity in astronomical and other natural phenomena, as well as the more strictly calendrical issue of how such phases and cycles were integrated into the numerically consistent patterns of economics, as in tribute collection, and of shamanist religion, as in the 260-unit arithmogram of Mesoamerica known as the tonalamatl (whose ultimate origins can be found in the nine moons that elapse between the first missed menses and birth). In the Mesoamerican area particular attention is paid to the long-standing debate over whether the calendrical year was the seasonal (tropical) year of agricultural tribute or the unvarying 365-day year intercalated into the tun calendar of the Maya lowlands, most papers favouring the former; and to the possibility that the Thompson Era date of 3113 BC is valid for the year and tun calendars alike, the inaugural "4 Movement" sign invoked by the former being the spring equinox of that year. As regards comparisons between the otherwise quite distinct societies of Mesoamerica and the Inca Tahuantinsuyu, parallels emerge in customs associated with the equinoxes and solstices and in the importance of both the sidereal and the synodic moon for the administration of tribute.

Two further papers related to the Symposium are not reproduced in full here. The first, by the late Rafael Girard, is very substantially quoted and drawn upon in Tichy's paper; the other, by Manuel Alvarado, is summarized in the Abstracts and Symposia reports published by the Congress. In order to tackle the thorny question of leap-day intercalation in Mesoamerica, Alvarado turns to the pre-Positivist tradition of Sahagún and the cleric Fábrega and proposes multiple readings of such native sources as the opening chapter of Borgia (pp. 1-8) and Madrid (pp. 77-78); his transcription of the latter is given in the appendix. In all, the papers presented at the Symposium and the discussion that attended

them may be hoped to reveal a little more of the rich intelligence responsible for the native American computation of time.

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FLOYD G. LOUNSBURY

The Base of the Venus Table of the Dresden Codex, and its Significance for the Calendar-Correlation Problem

The longcount date that appears in the preface to the Venus table of the Dresden Codex poses a problem that up to the present has resisted satisfactory solution. So also does one of the intervals tabulated in the fourth tier of numbers on that same page. These problems, which are related, bear on the astronomical circumstances and the chronology of the Venus table, and indeed on Mayan chronology in general; for the interpretation accorded to them affects crucially the solution of the Maya-to-European calendar-correlation problem. A resolution of the Venus problems is now at hand; and this opportunity is taken to present it. A brief review of the context precedes.

Background Information

A perpetual Venus calendar is presented on five consecutive pages of the Dresden Codex (pages 46-50 in traditional pagination, 25-29 in corrected order). A sixth page that is prior to these (page 24) contains prefatory material, including the problematic items referred to above. These two parts of the Venus table will be referred to respectively as the 'main table' and the 'preface'. (See Tables 1 and 2.)

In the main table the successive periods between expected first and last appearances of the morning star and first and last of the evening star are schematized as 236 days (morning star), 90 days (invisibility before and after superior conjunction), 250 days (evening star), and 8 days (invisibility at inferior conjunction), accounting thus for the 584 days of the mean synodic period of the planet. A sequence of five synodic periods, presented on the five pages of the table, constitutes the cycle that harmonizes the 584-day Venus calendar with the 365-day annual calendar or haab [5 x 584 = 8 x 365, = 2920]. Thirteen repetitions of the scheme, on as many lines of these five pages, harmonize it in turn with the running of the 260-day sacred almanac, or tzolkin, uniting all of these into a great cycle of length equal to two of the 52-year calendar rounds [13 x 2920 = 146 x 260, = 104 x 365, = 65 x 584, = 37960, = 2 CR]. The thirteen lines of almanac days are matched by three alternative lines of days from the annual calendar, the latter in effect turning the entire scheme into three separate tables of calendar-round days. It was shown by Teeple (1926, 1930) that the three tables were designed as replacements one for another, and that yet a fourth (the first in the series of replacements) is specified in the preface to the table. Moreover, the rule for providing additional lines of days from the annual calendar is clear, so that the useful life of the table is extendible indefinitely into the future. A transcription of the calendrical and numerical content of this table is

Table 1. The calendrical content of the Main Table of the Dresden Codex Venus pages. Horizontal blocks correspond to pages of the Codex (pp. 46-50). Reading order is preserved, with horizontal lines substituting for vertical columns. Noncalendrical portions are omitted. The 'base' positions of the table (last line) are in boldface.

46:																			
	3	11	6	1	9	4	12	7	2	10	5	13	8	CIB	4 Yaxkin	236	9 Zac	19 Kayab	236
	2	10	5	13	8	3	11	6	1	9	4	12	7	CIMI	14 Zac	327	19 Muan	4 Zotz	90
	5	13	8	3	11	6	1	9	4	12	7	2	10	CIB	19 Tzec	576	4 Yax	14 Pax	250
	13	8	3	11	6	1	9	4	12	7	2	10	5	KAN	7 Xul	584	12 Yax	2 Kayab	8
47:																			
	2	10	5	13	8	3	11	6	1	9	4	12	7	AHAU	3 Cumhu	820	3 Zotz	13 Yax	236
	1	9	4	12	7	2	10	5	13	8	3	11	6	OC	8 Zotz	910	13 Mol	3 Muan	90
	4	12	7	2	10	5	13	8	3	11	6	1	9	AHAU	18 Pax	1160	18 Uo	8 Chen	250
	12	7	2	10	5	13	8	3	11	6	1	9	4	LAMAT	6 Kayab	1168	6 Zip	16 Chen	8
48:																			
	1	9	4	12	7	2	10	5	13	8	3	11	6	KAN	17 Yax	1404	2 Muan	7 Zip	236
	13	8	3	11	6	1	9	4	12	7	2	10	5	IX	7 Muan	1494	7 Pop	17 Yaxkin	90
	3	11	6	1	9	4	12	7	2	10	5	13	8	KAN	12 Chen	1744	17 Mac	2 Uo	250
	11	6	1	9	4	12	7	2	10	5	13	8	3	EB	0 Yax	1752	5 Kankin	10 Uo	8
49:																			
	13	8	3	11	6	1	9	4	12	7	2	10	5	LAMAT	11 Zip	1988	16 Yaxkin	6 Kankin	236
	12	7	2	10	5	13	8	3	11	6	1	9	4	ETZNAB	1 Mol	2078	6 Ceh	16 Cumhu	90
	2	10	5	13	8	3	11	6	1	9	4	12	7	LAMAT	6 Uo	2328	11 Xul	1 Mac	250
	10	5	13	8	3	11	6	1	9	4	12	7	2	CIB	14 Uo	2336	19 Xul	9 Mac	8
50:																			
	12	7	2	10	5	13	8	3	11	6	1	9	4	EB	10 Kankin	2572	15 Cumhu	0 Yaxkin	236
	11	6	1	9	4	12	7	2	10	5	13	8	3	IK	0 Uayeb	2662	0 Tzec	10 Zac	90
	1	9	4	12	7	2	10	5	13	8	3	11	6	EB	5 Mac	2912	10 Kayab	15 Tzec	250
	9	4	12	7	2	10	5	13	8	3	11	6	**1**	**AHAU**	**13 Mac**	2920	**18 Kayab**	**3 Xul**	8

Table 2. Numerical and calendrical content of the Preface to the Venus Table of the Dresden Codex (Dr. 24).

[1 Ahau]	[18 Kayab]	[4 Ahau]	1.1.1.14.0	15.16.6.0	10.10.16.0	5.5.8.0
...	...	8 Cumhu	1 Ahau	1 Ahau	1 Ahau	1 Ahau
...	...	...				
...	...	...	1.5.14.4.0	9.11.7.0	4.12.8.0	1.5.5.0
...	...	...	1 Ahau	1 Ahau	1 Ahau	1 Ahau
...	...	...				
...			4.17.6.0	4.9.4.0	4.1.2.0	3.13.0.0
...	9	9	6 Ahau	11 Ahau	3 Ahau	8 Ahau
	9	9				
6	16	9	3.4.16.0	2.16.14.0	2.8.12.0	2.0.10.0
2	0	16	13 Ahau	5 Ahau	10 Ahau	2 Ahau
-0-	0	0				
4 Ahau	1 Ahau	1 Ahau	1.12.[8].0	1.4.6.0	16.4.0	8.2.0
8 Cumhu	18 Kayab	(18 Uo)	7 Ahau	12 Ahau	4 Ahau	9 Ahau

NOTE: Bracketed items are restorations (top left) and an emendation (the uinals digit in 1.12.8.0). The parenthesized item (18 Uo) is arithmetically out of place, due apparently to lack of alternative space. Hyphens flanking the zero of 6.2.0 (lower left) are for the ring of the 'ring number', marking it as negative. The columns of three dots are in lieu of noncalendrical hieroglyphs.

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Table 3. Chronology of the bases of the Dresden Codex Venus Table. (a) Mayan chronology, as determined by the intervals recorded in the Preface to the table. (b) Hypothetic Julian-Christian equivalents according to the Thompson correlation, JDN = MDN + 584285.

				-6. 2.0,	1 Ahau 18 Kayab	(O).	-3119 Aug 30.
-6. 2.0	+	9. 9.16. 0.0	=	9. 9. 9.16.0,	1 Ahau 18 Kayab	(A).	623 Feb 6.
9. 9. 9.16.0	+	5. 5. 8.0	=	9.14.15. 6.0,	1 Ahau 18 Kayab	(B).	727 Jan 11.
" " " " "	+	10.10.16.0	=	10. 0. 0.14.0,	1 Ahau 18 Kayab	(C).	830 Dec 16.
" " " " "	+	15.16. 6.0	=	10. 5. 6. 4.0,	1 Ahau 18 Kayab	(D).	934 Nov 20.
" " " " "	+	1. 1. 1.14.0	=	10.10.11.12.0,	1 Ahau 18 Kayab	(E).	1038 Oct 25.
" " " " "	+	1. 5.14. 4.0	=	10.15. 4. 2.0,	1 Ahau 18 Uo	(F).	1129 Dec 6.
10.10.11.12.0	+	4.12. 8.0	=	" " " " ",	" " " "	(").	" " ".
" " " " "	+	9.11. 7.0	=	11. 0. 3. 1.0,	1 Ahau 13 Mac	(G).	1227 Jun 15.
" " " " "	+	[14.10. 6.0]	=	11. 5. 2. 0.0,	1 Ahau 3 Xul	(H).	1324 Dec 22.

given here in Table 1.

The day from which any one such version of the table proceeds is conventionally known as its 'base'. This is its 'Day Zero' (not 'Day One'). The table is so constructed that its base is the day of an expected heliacal rising of Venus as morning star, four days after inferior conjunction, coinciding with an almanac day 1 Ahau. Its concluding day, when it is allowed to be run through to the end, is necessarily on the same calendar-round day as is its base; but it is two calendar rounds later in the longcount. It too should schedule a heliacal rising of the morning star on a day 1 Ahau; but because of a small discrepancy between the true mean synodic period of Venus (583.92 days) and the whole-number approximation employed by the Maya (584 days), the planet must necessarily tend to appear a few days ahead of time (about five days on the average) toward the end of the great cycle of the table. After initial experiments, and apparently only after this fact had become fully appreciated, the indicated practice was to stop short of a complete run of the table, at an earlier date where a 1 Ahau could be found that was closer to a heliacal rising of the morning star than would have been the one at the end of the table. This better alternative would then serve as a base (a new epoch) for the next run of the table. Locating the better alternative could be done by rule (once the rule was discovered): stop six and a half tuns short of a complete run in order to locate a 1 Ahau that will offer a four-day correction, or thirteen tuns short for one that will offer an eight-day correction. The almanac day 1 Ahau appears to have been inviolate for epochs of the morning star (it had a mythological charter); and with this constraint, the corrections can come only in four-day modules and at six-and-a-half-tun intervals. Successive bases are thus fixed in the almanac but are movable in the year. The primary base of the table is a day 1 Ahau 18 Kayab. This is the calendar-round day with which the Dresden Codex system began. Replacement bases are indicated at 1 Ahau 18 Uo, 1 Ahau 13 Mac, and 1 Ahau 3 Xul, in that order of succession, respectively effecting an eight-day and two four-day corrections.

The Problem

The chronological position of the 1 Ahau 18 Kayab base of the main table is not directly indicated in that table. Neither are those of the replacement bases, although they can be located relative to the primary base, and to each other, at successive intervals of 4.12.8.0, 4.18.17.0, and 4.18.17.0 (a doubly and two singly foreshortened runs of the table). The preface, however, highlights a day 1 Ahau 18 Kayab which it places at 9.9.9.16.0. The most natural assumption would be--and has usually been--that this must designate the primary base of the main table. The trouble with that, as Eric Thompson expressed it (1950: 226), is that "in no correlation so far suggested, which is not derived solely from astronomical data, does 9.9.9.16.0 coincide with a heliacal rising of Venus after inferior conjunction." Correlations can of course be coined ad hoc to accomplish this end when other pertinent evidence is ignored; but those that have taken historical evidence into account are not able to achieve it. Thompson noted that by his correlation (which is derived from post-Conquest historical data) the prediction is about sixteen days too early for the event. He therefore opted for an alternative suggested by Teeple (1930: 97-98), which was to identify the base of the main table with a 1 Ahau 18 Kayab that was eight calendar rounds later, at 10.10.11.12.0.

Justification for entertaining this as a possibility was found in the presence of the number 1.5.14.4.0 which is recorded in the fourth tier of the preface (see Table 2). Teeple noted that "this number consists of eight calendar rounds plus 4.12.8.0, the length of the 1 Ahau 18 Kayab table" (i.e., as foreshortened by thirteen tuns).

It is this number that poses the other part of the problem. Its interval can be seen as consisting of eight calendar rounds (1.1.1.14.0) plus 4.12.8.0, i.e., of four complete runs of the main table plus one doubly foreshortened one; or it can be seen as consisting of six calendar rounds (15.16.6.0) plus twice 4.18.17.0, i.e., of three complete runs of the main table plus two singly foreshortened ones. In either case it is an interval that combines periods of uncorrected error accumulation with another, or others, providing partial but insufficient correction in such proportion as to leave a net residual error of about seventeen days [1.5.14.4.0 = 185120, = 317(583.92) + 17.36].

This number, moreover, when applied to a day 1 Ahau 18 Kayab, leads to a day 1 Ahau 18 Uo (the first of the replacement bases). But it is not the only number specified there that does so; for so also does 4.12.8.0, which is recorded in the same tier. Either these two numbers were intended to apply to two different dates 1 Ahau 18 Kayab that are eight calendar rounds apart (as are 9.9.9.16.0 and 10.10.11.12.0) and to lead to the same 1 Ahau 18 Uo; or else they were to apply to the same 1 Ahau 18 Kayab (which one?) and to lead to two different 1 Ahau 18 Uo dates eight calendar rounds apart. There is nothing in the context to warrant, or even to suggest, entertaining the second of these notions; for there is no indication of more than one 1 Ahau 18 Uo date. Other 1 Ahau 18 Kayab dates, however, are indicated or implied. The ring-number base in the preface records one at minus 6.2.0, a mythical charter date seventy-two calendar rounds before the one of 9.9.9.16.0, and thus prior to the epoch of the longcount. And the top tier of numbers in the preface records the first four multiples of the grand-cycle length of the main table, together with specifications that they lead to days 1 Ahau, which in a context implying application to 1 Ahau 18 Kayab, would refer to four different resultant dates on this day at successive two-calendar-round intervals. There are thus five 1 Ahau 18 Kayab dates in historical time indicated in the preface, in addition to one in mythic time. Their chronology, together with that of the indicated replacement bases, can be outlined as in Table 3, employing the intervals recorded in the preface.

But the problem remains. What can have been the rationale for a number like 1.5.14.4.0, with such a seemingly inappropriate property? And why was the date 9.9.9.16.0 given such prominence and made the focus of the preface if it was not the intended base of the main table or even a historical heliacal-rising date? Its discrepancy by the Thompson correlation has posed for many a serious obstacle in the way of their acceptance of that correlation. I hope now to remove that obstacle.

An Astronomical Test

In the following pages there are presented some data drawn from the Tuckerman planetary tables, together with conclusions that appear to be inferrible from the data. The Thompson correlation will be assumed (in its original value: Julian day number = Maya day number + 584285), since I am

convinced that it represents the truth; but it can as well be understood merely as a working hypothesis, about to be put to a test.

The Venus table of the Codex assigns a mean value of eight days for the duration of the planet's invisibility at inferior conjunction, without representing the deviations from that mean for particular periods (which would have been infeasible because of the inconstancy of their distribution over the span of time covered by the table). The moment of conjunction must therefore be ascribed to the middle of this eight-day period, though it too represents a mean with deviations because of variability in the planet's synodic period. Thus, corresponding to any one of the prescribed days for an anticipated heliacal rising of the Morning Star, there is assumed a mean position for inferior conjunction four days earlier.

It is of interest to see how good may be the match between predictions from the Dresden Codex table and the astronomical computations for the same phenomena as obtainable from planetary tables. For example, consider the date to which Thompson ascribed the 1 Ahau 18 Kayab base of the Venus table. In his interpretation this was eight calendar rounds after 9.9.9.16.0, which is 10.10.11.12.0, or by his correlation, A.D. 1038, October 25 (Julian). According to the codex table, this should be a mean position for a heliacal rising of Venus. The predicted position for the inferior conjunction is therefore four days earlier, on 10.10.11.11.16, 10 Cib 14 Kayab, A.D. 1038, October 21. Consulting the Tuckerman tables, however, we see that the inferior conjunction actually occurred seven days earlier than this, on October 14. Thus, a positive error of seven days must be ascribed to the prediction for this event, requiring a minus seven-day correction.

The error in a single datum such as this is not by itself, however, any reliable indication of the validity of the espoused interpretation of the table, for the reason that the durations of individual synodic periods of the planet deviate from the approximately 584-day mean by varying amounts, up to three or four days either side of that mean. These deviations fluctuate back and forth within a five-period cycle for short terms (the 2920 days of the five-page span of any one line of the Dresden Codex table), with a further slow circulation of their distribution over longer periods of time. What is needed then is not a single datum such as that just illustrated, but rather a set of five consecutive ones whose separate errors can be averaged. When the preceding ones in this case are determined, to make the required set of five, it is seen that their errors were respectively +5, +4, +7, +3, and +7, in that order, to the nearest whole day in each case. That is to say, the predictions overshoot their respective targets by those amounts, and they require corrections of -5, -4, -7, -3, and -7 days to bring them into accord with the real phenomena. The mean of this set of errors is 5.2 days--a number that has a familiar ring! [It is equal to 65 x 0.08, the accumulation of mean error in one complete run of the table of the codex.]

When the same test is made for the set of five inferior conjunctions just prior to the 1 Ahau 18 Kayab of 9.9.9.16.0, which is A.D. 623 February 6 (Julian) by the Thompson correlation, it is found that the individual errors at this time were -14, -16, -16, -14, and -17 days respectively, again to the nearest whole day in each case. These predictions--if that is what they were--fall short of their targets by these amounts, and would require corrections of those magnitudes, with opposite sign, to bring them

into line with the phenomena. The mean of this set of errors is -15.4 days.

The same test can be carried out for the inferior conjunctions prior to each of the intermediate 1 Ahau 18 Kayab dates that are indicated in the top tier of the prefatory table in the codex. The one next prior to Thompson's base date is of particular interest. This is six calendar rounds after 9.9.9.16.0, viz., 10.5.6.4.0, which by the assumed correlation is A.D. 934, November 20 (Julian). The errors in this set of predictions are +1, -2, +2, -1, and 0, to the nearest whole day. The mean of the set is 0.0 days.

At the two remaining indicated 1 Ahau 18 Kayab positions--two and four calendar rounds after 9.9.9.16.0--the corresponding mean errors for the sets of five are -5.0 days (for the set just prior to 10.0.0.14.0) and -10.2 days (for that prior to 9.14.15.6.0).

The errors and mean errors may be determined also for the predicted inferior-conjunction dates associated with the 1 Ahau 18 Uo, 1 Ahau 13 Mac, and 1 Ahau 3 Xul bases, as these are distributied chronologically in the Teeple-Thompson interpretation. These were termination dates of cycles that were foreshortened for the purpose of error reduction, a 4680-day foreshortening (13.0.0) accomplishing an eight-day correction in the first of these, and two 2340-day foreshortenings (6.9.0) for two separate four-day corrections in the other two. At each of these dates there are two values of the error function: one for the prior location of the date in the Venus table, and one for its relocation in the base position. The two error values differ by amounts of 8 days, 4 days, and 4 days respectively in the three cases, for the reasons just noted.

The data for all of these error determinations are presented in Table 4. The table contains eight sets, with five hypothetic inferior-conjunction dates in each, these being in every case four days prior to a presumptive heliacal-rising date scheduled by the Dresden Codex table. The first five sets are those which are just prior to the five 1 Ahau 18 Kayab bases (A-E) indicated in the preface to the codex table; the final three sets are those just prior to the 1 Ahau 18 Uo, 1 Ahau 13 Mac, and 1 Ahau 3 Xul replacement bases (F-H). The last inferior-conjunction date of each set is designated by the same letter (from A to H) as is used in Table 3 to label the base that follows it four days later. For example, the last date of the first set of Table 4 is designated as inferior conjunction A (at 9.9.9.15.16); it is four days prior to the base that is designated as base A (9.9.9.16.0) in Table 3. The others of the set are at 584-day intervals (1.11.4) successively prior to that. [NOTE: The use of the capital letters A-H to designate successive bases follows the practice introduced by Thompson (1950: 226), except that his B, which was spurious, is here omitted; his C therefore here becomes B, and so on to the end of the series.]

The columns of Table 4 give the following information:

(1) Maya day numbers in longcount notation for predicted dates of inferior conjunction, according to the chronological interpretation of the Dresden Codex Venus table and its preface that was outlined in Table 3.

(2) The corresponding Julian day numbers, according to the Thompson correlation: Julian day number = Maya day number + 584285.

Table 4. Predicted dates of inferior conjunction of Venus, in sets of five, preceding each of the eight successive bases indicated in the Dresden Codex tables; together with corresponding actual dates, errors of prediction, and mean errors per set. (Maya-to-Julian by the 584285 correlation.)

	Predicted dates of inferior conjunction			Actual dates of inferior conjunction	Errors of prediction	Mean errors per set
	Maya longcount day number	Julian day number	Chr. year, & Jul. cal. day			
	9. 9. 3. 7. 0	1946305	616 Sep 10	616 Sep 24	-14	
	9. 9. 5. 0. 4	6889	618 Apr 17	618 May 3	-16	
	9. 9. 6.11. 8	7473	619 Nov 22	619 Dec 8	-16	
	9. 9. 8. 4.12	8057	621 Jun 28	621 Jul 12	-14	
(A)	9. 9. 9.15.16	8641	623 Feb 2	623 Feb 19	-17	-15.4
	9.14. 8.15. 0	1984265	720 Aug 15	720 Aug 23	-8	
	9.14.10. 8. 4	4849	722 Mar 22	722 Apr 3	-12	
	9.14.12. 1. 8	5433	723 Oct 27	723 Nov 6	-10	
	9.14.13.12.12	6017	725 Jun 2	725 Jun 11	-9	
(B)	9.14.15. 5.16	6601	727 Jan 7	727 Jan 19	-12	-10.2
	9.19.14. 5. 0	2022225	824 Jul 20	824 Jul 23	-3	
	9.19.15.16. 4	2809	826 Feb 24	826 Mar 3	-7	
	9.19.17. 9. 8	3393	827 Oct 1	827 Oct 5	-4	
	9.19.19. 2.12	3977	829 May 7	829 May 12	-5	
(C)	10. 0. 0.13.16	4561	830 Dec 12	830 Dec 18	-6	-5.0
	10. 4.19.13. 0	2060185	928 Jun 24	928 Jun 23	+1	
	10. 5. 1. 6. 4	0769	930 Jan 29	930 Jan 31	-2	
	10. 5. 2.17. 8	1353	931 Sep 5	931 Sep 3	+2	
	10. 5. 4.10.12	1937	933 Apr 11	933 Apr 12	-1	
(D)	10. 5. 6. 3.16	2521	934 Nov 16	934 Nov 16	0	0.0
	10.10. 5. 3. 0	2098145	1032 May 29	1032 May 24	+5	
	10.10. 6.14. 4	8729	1034 Jan 3	1033 Dec 30	+4	
	10.10. 8. 7. 8	9313	1035 Aug 10	1035 Aug 3	+7	
	10.10.10. 0.12	9897	1037 Mar 16	1037 Mar 13	+3	
(E)	10.10.11.11.16	2100481	1038 Oct 21	1038 Oct 14	+7	+5.2
	10.14.17.11. 0	2131425	1123 Jul 11	1123 Jul 8	+3	
	10.14.19. 4. 4	2009	1125 Feb 14	1125 Feb 15	-1	
	10.15. 0.15. 8	2593	1126 Sep 21	1126 Sep 18	+3	
	10.15. 2. 8.12	3177	1128 Apr 27	1128 Apr 26	+1	
(F)	10.15. 4. 1.16	3761	1129 Dec 2	1129 Dec 1	+2	+1.4
	10.19.16.10. 0	2167045	1221 Jan 17	1221 Jan 17	0	
	10.19.18. 3. 4	7629	1222 Aug 24	1222 Aug 20	+4	
	10.19.19.14. 8	8213	1224 Mar 30	1224 Mar 29	+1	
	11. 0. 1. 7.12	8797	1225 Nov 4	1225 Nov 1	+3	
(G)	11. 0. 3. 0.16	9381	1227 Jun 11	1227 Jun 8	+3	+2.2
	11. 4.15. 9. 0	2202665	1318 Jul 27	1318 Jul 22	+5	
	11. 4.17. 2. 4	3249	1320 Mar 2	1320 Mar 1	+1	
	11. 4.18.13. 8	3833	1321 Oct 7	1321 Oct 2	+5	
	11. 5. 0. 6.12	4417	1323 May 14	1323 May 11	+3	
(H)	11. 5. 1.17.16	5001	1324 Dec 18	1324 Dec 16	+2	+3.2

(3) The corresponding Christian year and Julian calendar dates.

(4) The actual dates of inferior conjunction, as determined from the Tuckerman planetary tables.

(5) The errors of prediction: negative when the table predicts too early, positive when too late.

(6) The mean errors, per set of five, corresponding to the five-period cycle.

The error magnitudes from the last two columns are the object of our interest. They are as follows:

Set A.	-14,	-16,	-16,	-14,	-17;	mean error: -15.4 days.
Set B.	-8,	-12,	-10,	-9,	-12;	mean error: -10.2 days.
Set C.	-3,	-7,	-4,	-5,	-6;	mean error: -5.0 days.
Set D.	+1,	-2,	+2,	-1,	0;	mean error: 0.0 days.
Set E.	+5,	+4,	+7,	+3,	+7;	mean error: +5.2 days.
Set F.	+3,	-1,	+3,	+1,	+1;	mean reduced error: +1.4 days.
Set G.	0,	+4,	+1,	+3,	+3;	mean reduced error: +2.2 days.
Set H.	+5,	+1,	+5,	+3,	+2;	mean reduced error: +3.2 days.

Those listed for Sets F, G, and H are the reduced errors, after relocation of their respective dates to positions just prior to bases of the table. In their original locations they are eight days greater in Set F, and four days greater in sets G and H, their means being respectively 9.4, 6.2, and 7.2 days.

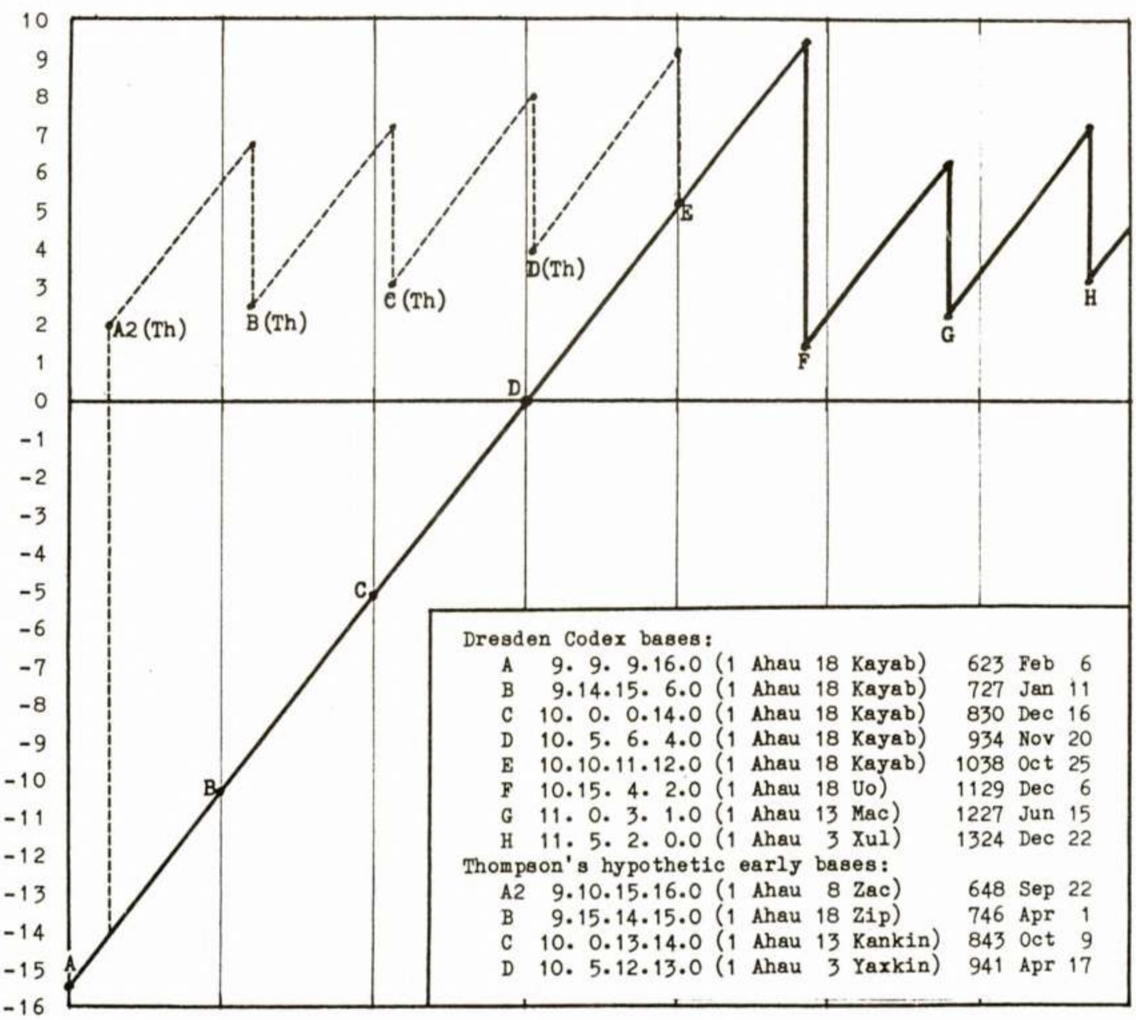
The sequence of mean errors from this tabulation, for the indicated runs of the Venus table from 9.9.9.16.0 (the first 1 Ahau 18 Kayab) to 11.5.2.0.0 (1 Ahau 3 Xul), is graphed in Figure 1. The abscissas of the points represent the chronology of the bases; the ordinates are the magnitudes of the accumulated mean errors.

That the progression of mean-error magnitudes for the first five sets should be linear, and that the slope of their graph should be approximately 5.2 days per two calendar rounds, could of course be known in advance. It was not necessary to extract data from the planetary tables in order to demonstrate that. (The slight deviations from the 5.2-day module in the cited values are merely an artifact of the use of whole-day approximations in computing dates and individual errors.) What could not have been known in advance was their actual values, or that their graph would cross the zero line on exactly one of the 1 Ahau 18 Kayab dates. It was to obtain the actual values, not their differences, that the data in Table 4 were assembled. The results turn out to be more interesting than anticipated. The following points deserve note:

(1) At inferior conjunction D, four days prior to base D, the error in the prediction from the Dresden Codex table is zero. Also equal to zero at this time is the mean error for the set of five inferior conjunctions prior to the base. Base D, moreover, is the only one in the series of 1 Ahau 18 Kayab bases for which this is true. It is therefore the best qualified base, and hence the most probable one, for the historical institution of the 18 Kayab line of the Dresden Codex table.

(2) This was a unique event in historical time. For a given calendar-round day (say 1 Ahau 18 Kayab) to recur at a given point in the astronomical Venus cycle (say four days after a mean inferior-conjunction position),

Fig. 1 Mean-error graph for predicted times of inferior conjunction of Venus:
(a) SOLID LINES, according to the prescriptions of the Dresden Codex tables;
(b) BROKEN LINES, Thompsons's hypothetic early base sequence.
Abscissas represent time, marked at two-calendar-round intervals (104 years). (Abscissas of the bases are tabulated inside the frame of the graph.)
(Julian-Christian equivalents are by the 584285 correlation)
Ordinates represent mean errors, in days, averaged for the five successive inferior conjunctions immediately prior to each of the specified bases.



or for such a position in the Venus cycle to return again to a given day in the calendar round, is not possible within the dimensions of historical time. It can be approximated to within about five days (give or take a day or two) after just two calendar rounds; but this is hardly close enough to count as 'same point' or 'same day'. The next such approximation is not attainable until after 111 or 113 calendar rounds (ca. 5768 or 5872 years), at which times the deviation is once more reduced to within the plus-or-minus five-day range. After that, it cannot happen again until after a total of 224 calendar rounds have passed (ca. 11,640 years). Thus, if there was ever a heliacal rising of Venus on a day 1 Ahau 18 Kayab that motivated the ascription that is made in the Dresden Codex, and if the Thompson correlation is correct (or any correlation that respects Landa's equation), then the one of base D was it. Its date was A.D. 934 November 20 (Julian), equal to Maya 10.5.6.4.0 by the Thompson correlation. There can have been no other.

(3) The first historical run on the 18 Kayab line of the table must have proceeded from that date. It continued through the entire length of the table, two full calender rounds, reaching the next 1 Ahau 18 Kayab base at 10.10.11.12.0, A.D. 1038 October 25; whereupon a second run, on the same 18 Kayab line, went forward from this latter base. It is apparent that the mean error had been accumulating and that a correction was already due before this second run began; but none was made. The most obvious and probable reason for the failure to correct at this time is simply that the ingenious method for accomplishing it had not yet been discovered. It might also have been that the Maya astronomers were not yet fully convinced that this was to be an irreversible accumulating error, rather than an oscillating one. The invention of the correction device is thus best ascribed to the period between bases E and F, i.e., after the last of the 1 Ahau 18 Kayab bases (10.10.11.12.0), before which it should have been applied but wasn't, and before the 1 Ahau 18 Uo base (10.15.4.2.0), when a double correction was applied. This places it in the interval between A.D. 1038 and 1129. Its institution is one of the matters commemorated in the prefatory page of the Dresden Codex table.

(4) The chronology of the succeeding segments of the graph is familiar, as it follows the Teeple-Thompson arrangement of bases E through H (Thompson's F through I). An 18 Uo line, though absent from the main table, is implied by recorded intervals and is explicitly noted in the preface. Its absence from the main table is explainable if it is assumed that it was already obsolete when the codex was composed, the current line then being the one of 13 Mac. This would be the appropriate recension, then, for a period beginning in A.D. 1227 (11.0.3.1.0). [In an earlier paper (1978: 788) I conjectured that the current base was the one of 18 Uo. That, I am now sure, was a mistake.] The retention of the 18 Kayab line, thought it also belonged to the past, is explainable as being due to its special status as the original of this formulation, and to its adoption as the ultimate reference to which to relate succeeding replacements. (Another possible function will be noted later.) Looking to the future, the next replacement--the 3 Xul line (to take effect 11.5.2.0.0, A.D. 1324)--was already reckoned and included in the table. It would have been the most recent contribution to the table as it stands in the codex, occupying a line that may have been held by 18 Uo in a previous version.

(5) The error graph over the periods prior to base D clearly reflects an uncorrected backward extrapolation of the Venus calendar, employing the

whole-number approximation for its reckoning (584 days per synodic period, or two calendar rounds per grand cycle). It cannot possibly reflect any series of past observations; else its slope would be zero. It is thus a computational figment, as is also the 9.9.9.16.0 hypothetic base which it has as its initial terminus. Neither can this stretch be dispensed with in interpretation of the table; for not only is it implied by the stated increments of two, four, six, and eight calendar rounds in the top tier of the prefatory table, but it is made inescapable by two of the increments specified in the fourth tier, viz., 4.12.8.0 and 1.5.14.4.0, which derive the 1 Ahau 18 Uo base from two different 1 Ahau 18 Kayab bases eight calendar rounds apart. A question is thereby posed: Why should there be an extrapolation of this particular length--six calendar rounds--rather than of some other length? Or why one leading to 9.9.9.16.0, rather than to some other equally artificial prior base? If a plausible motive for this particular extrapolation were to be identified, the solution to the most vexing problem in the interpretation of the Dresden Codex Venus table would be at hand.

1 Ahau 18 Kayab

It is possible now to offer a reason for the extrapolation and for its particular length, as well as for the choice of the day 1 Ahau 18 Kayab as an epoch for Venus reckonings. The two matters are related. As for the latter, that choice can hardly have been motivated by considerations of frequency; for the date of base D was the only time in all of Maya history when there could have been a heliacal rising of Venus on the morning of a day 1 Ahau 18 Kayab, or an inferior conjunction of Venus on a day that is four days prior to that position in the calendar round. Therefore, either it was fortuitous (i.e., for a nonastronomical reason) that they chose 1 Ahau 18 Kayab as the primary base of the Venus table of the codex, or else there was something special about this one.

As already noted, the date of base D by the 584285 correlation was November 20 (Julian) of the year 934. On that date Venus and Mars came into conjunction with each other; and that must also have been the date of their heliacal rising, i.e., of first sighting as morning star at the horizon, just ahead of the sun, after their respective periods of invisibility (short for Venus, considerably longer for Mars). Though the moment of their conjunction was toward the end of the day (ca. 11:20 p.m., 90th-meridian time), they were close to each other as they rose that morning, with about nine-tenths of a degree between them, Mars ahead of Venus; and by the next morning they had changed places, with about a third of a degree between them, Venus ahead of Mars. On November 20 their western elongations at rising time were about 6.6 degrees for Venus and about 7.5 degrees for Mars; by the next morning, at the same time, they were about 8.2 degrees for Venus and 7.8 degrees for Mars. Their latitudes (from the ecliptic) were close to zero: -0.16 of a degree for Venus, and -0.14 for Mars. Their situation with respect to each other can be seen in the graphs of Figure 2, in which the celestial longitudes of Venus, Mars, and Sun are plotted for this date and for some intervals before and after. [The plotted points and the abscissas on the graph are for 10:00 a.m. at 90 degrees west, because these are the values that can be taken most easily from the Tuckerman tables (which are for 7:00 p.m. at 45 degrees east).] As for the question of their possible visibility just before dawn on these dates, the following considerations are pertinent:

(1) The minimum necessary elongation of Venus from the sun in order to be visible at the horizon ranges from two or three degrees to nine or ten, depending on the time of the year (and other less regular factors). For the third week in November it is about five and a quarter degrees. On November 20 of the year with which we are concerned the actual elongation was about 6.6 degrees; on November 19, the morning before, it was about 5.0 degrees. Thus, so far as this condition is concerned, it is unlikely that it could have been sighted on the 19th, but it is both possible and probable that it was seen on the 20th. (2) The corresponding requirement for Mars is greater than that for Venus, because of Mars' lesser brilliance. It is thus not possible for it to have been seen as a separate body on the morning of the 20th; but in the days that followed, as the two planets separated from each other, it would sooner or later have become apparent that what had initially been perceived as one celestial body was in fact two, and that Mars had been in conjunction with Venus —a fact which the Maya astronomers might have anticipated and whose confirmation they may have been awaiting. [NOTE: Attempts to calculate and to quantify empirically the conditions for first and last morning or evening visibility of a planet or a star at the horizon have been in terms of what is known as its arcus visionis, the necessary depression (negative altitude) of the sun below the horizon at that moment. The concept and the procedure go back at least to Ptolemy. See Schoch (1924), Langdon, Fotheringham, and Schoch (1928: 49-52, 94 ff.), van der Waerden (1943), Huber (1982: 11-14, 84-87), and Weir (1982: 40 ff.), as well as Ptolemy's Almagest (Manitius 1963, II: 393-4). Here I have expressed it simply in terms of the planet's elongation from the sun, which in the tropics, for present purposes, is a sufficiently close approximation. The two values coincide on dates of the ecliptic's zenith passage, and in Mayan latitudes the maximum difference between them (at the winter solstice) amounts to something between four-tenths and eight-tenths of a degree, which difference I have attempted to take into consideration.]

If we assume that the almanac day 1 Ahau was already mythologically chartered as a day special to the Morning Star Venus (and there are reasons for suspecting that this goes well back into the Classic period), then its heliacal rising on this date, a "1 Ahau", would by virtue of this fact alone have been a marked event; for this is something that can be approximated no oftener than once every 97 and a half years or so. And its conjunction with Mars on this occasion would have made it doubly marked. The Maya astronomers (their 'god watchers') could not have failed to take note of it. The zero value of the Venus error graph on this date implicates it as the starting date for the Dresden Codex table. The coincidence of these facts can hardly be fortuitous.

Having Mars in the picture along with Venus has an interesting consequence. The mean synodic period of Mars is 779.94 days. That of Venus is 593.92 days. The error graph shows that during this time, and for well over a century thereafter, the length of the Venus period was being reckoned as a whole number, 584 days, without correction. So it can be assumed that the period of Mars was also, viz., as 780 days, or three lengths of the almanac. The lowest common multiple of these two numbers is exactly six calendar rounds [113880 = 6 x 18980, = 146 x 780, = 195 x 584]. The error graph shows that the problematic 9.9.9.16.0 base was a six-calendar-round extrapolation back from the indicated starting date of the table. We have now, in the Mars-Venus relationship, a likely reason for the magnitude of that extrapolation.

Fig. 2 Celestial longitudes of Venus, Sun, and Mars on November 20, A. D. 934, and during periods immediately preceding and following.

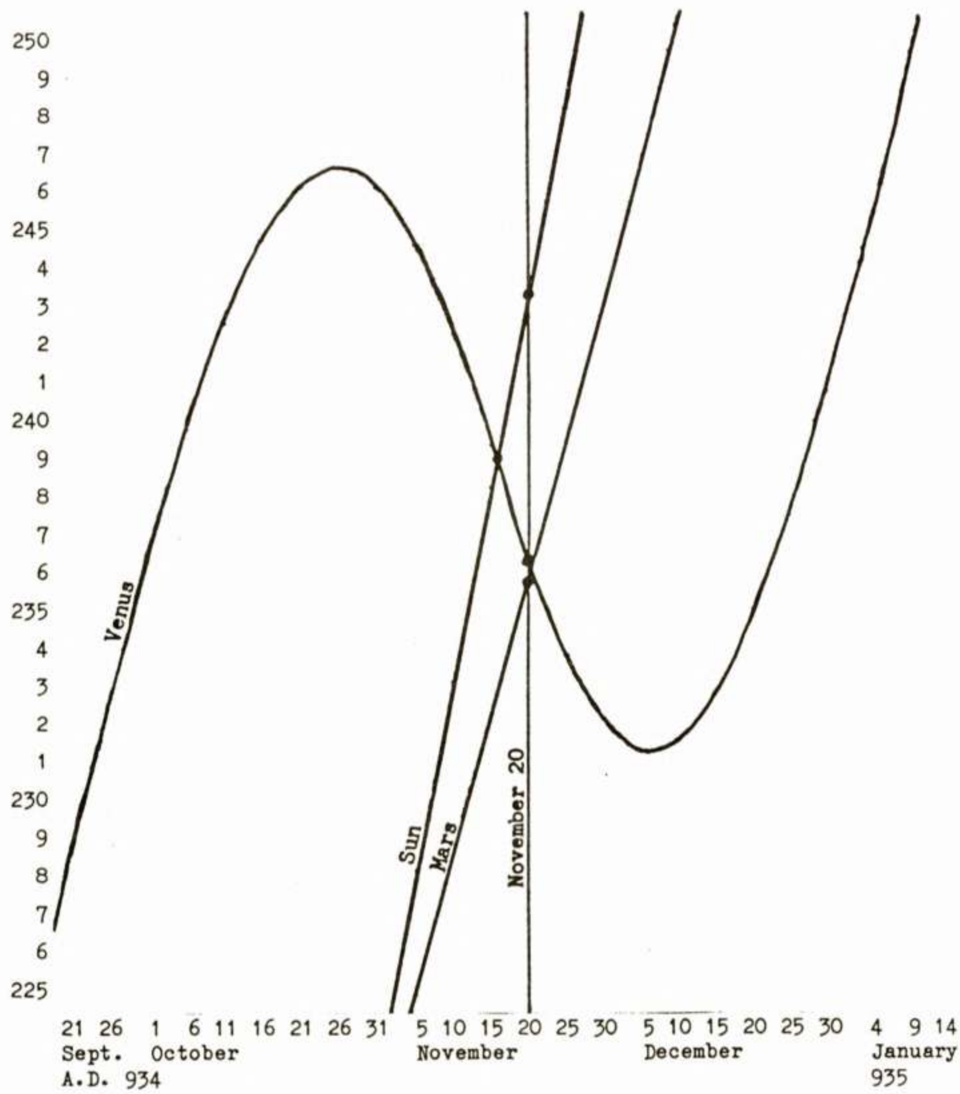
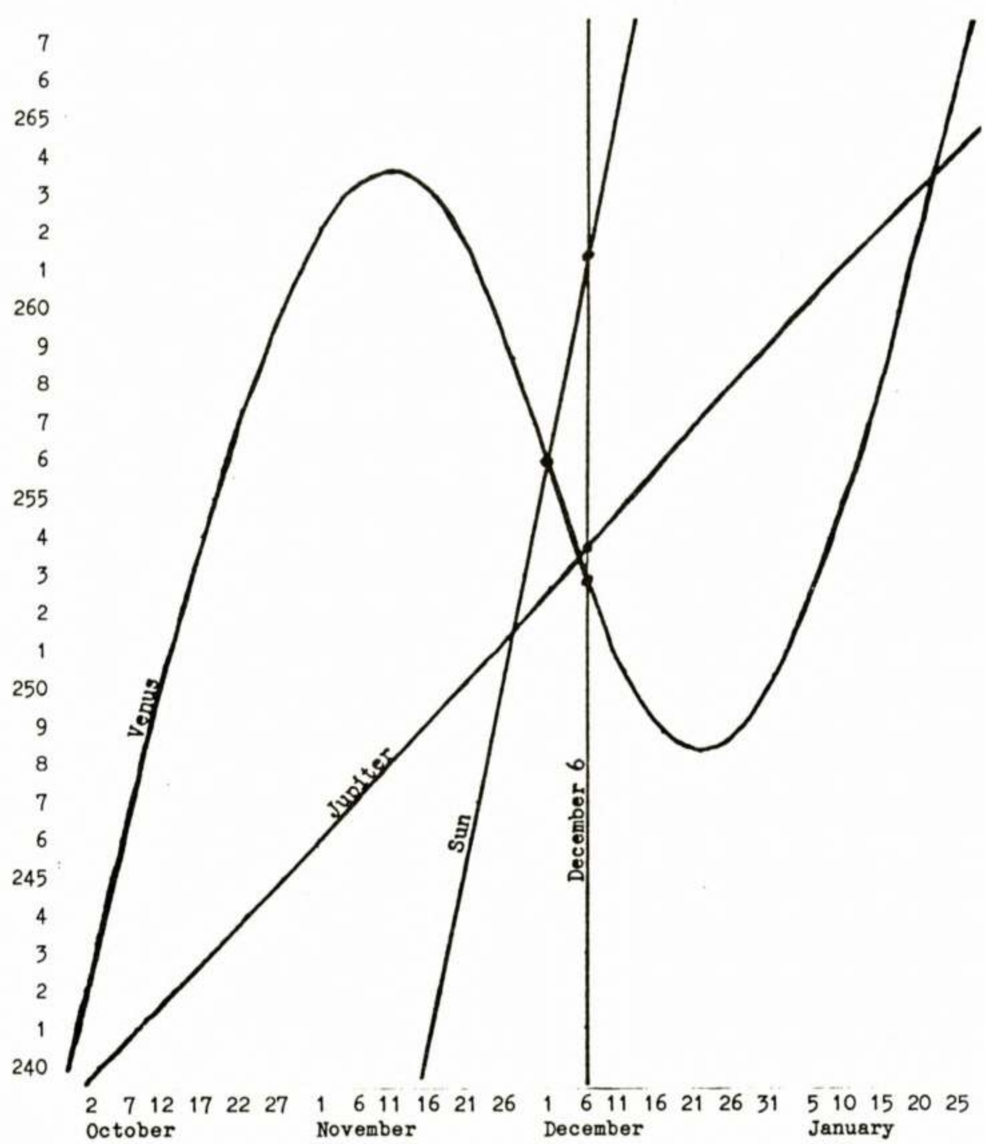


Fig. 3 Celestial longitudes of Venus, Sun, and Jupiter on December 6, A.D. 1129, and during periods immediately preceding and following.



If a separate reason be required for the extrapolation (apart from that for its particular magnitude), and for making the fictitious base the focal piece of the preface, it could perhaps be said that this was a good 'Maya' thing to do; in fact they didn't stop with just that, but extended it another twelve times that length, setting up yet another fictitious base on another day 1 Ahau 18 Kayab, this one before the beginning of the current longcount era. The one at 9.9.9.16.0 is a first step in that long projection into the past, establishing a Venus-Mars compound cycle of six calendar rounds, after which its twelfth multiple reaches into mythic time prior to the chronological epoch. That is the whole point of a ring-number base; it is to find a pre-zero precedent, viz., a date that is similar in its properties to an important historical date, and that can be reached by a long-reckoning number that is an integral multiple of all of the pertinent cycles. (Cf. Lounsbury 1976.)

There could also have been a practical use for the 9.9.9.16.0 base. The Maya astronomers must have been in possession of a sizable collection of records of planetary observations prior to the 1 Ahau Venus-Mars event of 10.5.6.4.0, and prior to the codification of the Venus calendar with the 18 Kayab of that date as its base. The hypothetic base six calendar rounds earlier would have been a useful construct. It would have permitted forward rather than backward reckonings to the observational data. During the period covered by perhaps the majority of the records its error would have compensated fairly well for the other error that is contained in the use of a table premised on whole-number reckoning.

The extrapolations may thus be understood as 'historical reconstructions' on the part of the Maya astronomers, for the purpose of fixing bench marks: the proximate one (9.9.9.16.0) for reckonings in recent history, and the ultimate one (-6.2.0) for determining the supposed start of it all in the current order of the universe. And they are yet another manifestation of the Maya interest in compound cycles.

1 Ahau 18 Uo

In an earlier section, reasons were suggested as to why a corrective foreshortening of the grand cycle and a resulting base shift were not instituted prior to 10.10.11.12.0, when they were clearly overdue, and why a second historical run of the table—carrying along an already accumulated mean error of five days—was allowed to proceed from the 1 Ahau 18 Kayab of that date. The proposed reasons were (1) that the ingenious method for accomplishing the correction had not yet been discovered, and (2) that the Maya astronomers may not yet have been fully convinced that this was to be an irreversible and steadily accumulating error rather than an oscillating and eventually self-correcting one. There is now another reason that appears plausible: (3) it might well have been, because of the extraordinary Mars-Venus coincidence of 10.5.6.4.0, and because of the investment in theoretical constructs derived therefrom, that the commitment to 1 Ahau 18 Kayab bases was too strong for these easily to be set aside; it may have been not only 1 Ahau that was sacrosanct, but 18 Kayab as well. If this were the case, it would have taken some other extraordinary event to break the precedent and set a new one. By one of those strokes of cosmic luck with which the Maya astronomers seem to have been blessed (and contrary to our sense of reasonable probabilities) such an event did take place on 1 Ahau 18 Uo, 10.15.4.2.0, thirteen tuns before the end of the second run

of the table on the 18 Kayab line. By the 584285 correlation, that was December 6 (Julian) of the year 1129; and on that date there was a reenactment of the event of 1 Ahau 18 Kayab, 10.5.6.4.0 (A.D. 934, November 20), but with Jupiter in the earlier role of Mars. Their situation is shown in Figure 3. Western elongations at rising time were about 8.28 degrees for Venus and 7.55 for Jupiter, with latitudes of 2.48 degrees north of the ecliptic for Venus and 0.38 north for Jupiter. Their moment of conjunction in longitude was about two hours after sunrise of the previous day, and it cannot be ruled out that they might actually have been sighted that morning. It was a time of the year when the magnitude of the elongation required for a first visibility of Venus was decreasing and was between six and five degrees. Jupiter, however, like Mars, requires a somewhat greater elongation for separate visibility; and it may again have been some days before their separate identities were resolved (and the anticipations of the astronomers verified). In any case, when the nature of the situation had become clear, it would have been seen that the 1 Ahau rising of that date was an extraordinary one. If a sign were needed to persuade holdouts that the time had come to let go of 18 Kayab, and that it was propitious for another 1 Ahau (which would also eliminate most of the by now accumulated nine-day error), this could well have been it. Once instituted, the device of base shifting could be applied thereafter as needed, as indeed it was.

Introduction of this present datum into the picture for 1 Ahau 18 Uo might seem to weaken the case for the Mars-Venus conjunction that was taken to have endowed 1 Ahau 18 Kayab with special significance; for with two such cases at hand it might be supposed that it is not too hard to find convenient conjunctions and simultaneous heliacal risings of the planets on suitable occasions. That impression, however, would be false. The last time prior to A.D. 934 when Venus was in conjunction with Mars at or within a day of heliacal rising was in A.D. 6. And the last time prior to A.D. 1129 when Venus came close to being in conjunction with Jupiter in approximately similar circumstance was in A.D. 244. And neither of these was even close to a day 1 Ahau. These give an indication of the frequency of such events. They are, for the problem at hand, 'once only'.

Some Other Chronological Interpretations

1. Thompson (1950). The chronology posited here (as in Table 3 and in Figure 1) includes only the dates and intervals for which explicit authority is found in the codex. It agrees only in part with Thompson's (1950: 226); for he made some speculative backward extrapolations of his own. The two schemes agree with each other in their placement of base A at the beginning of the sequence, and of E, F, G, and H at the end of it (Thompson's F, G, H, and I); but between A and E (Thompson's F) he posited four bases for which there is neither calendrical nor numerical evidence in the codex, reconstructing these on the basis of an assumption that the Venus calendar was in working order by 9.9.9.16.0 and that the device of corrective six-and-a-half-tun foreshortenings was then known and was being applied, and not supposing that the series of two-calendar-round multiples in the top tier of the preface were intended as base determiners. His hypothetic sequence, starting with base A, was the following (relettering his B to I as A2 to H to facilitate comparison with ours):

	9. 9. 9.16.0	(A)	1 Ahau 18 Kayab	[623 Feb 6]
+ 1. 6. 0.0 =	9.10.15.16.0	(A2)	1 Ahau 8 Zac	[648 Sep 22]
+ 4.18.17.0 =	9.15.14.15.0	(B)	1 Ahau 18 Zip	[746 Apr 1]
+ 4.18.17.0 =	10. 0.13.14.0	(C)	1 Ahau 13 Kankin	[843 Oct 9]
+ 4.18.17.0 =	10. 5.12.13.0	(D)	1 Ahau 3 Yaxkin	[941 Apr 17]
+ 4.18.17.0 =	10.10.11.12.0	(E)	1 Ahau 18 Kayab	[1038 Oct 25]
+ 4.12. 8.0 =	10.15. 4. 2.0	(F)	1 Ahau 18 Uo	[1129 Dec 6]
+ 4.18.17.0 =	11. 0. 3. 1.0	(G)	1 Ahau 13 Mac	[1227 Jun 15]
+ 4.18.17.0 =	11. 5. 2. 0.0	(H)	1 Ahau 3 Xul	[1324 Dec 22]

His reconstructed bases A2 to D are derived by backward reckonings from base E, employing singly foreshortened runs of the table, until left with a remainder of 1.6.0.0 between his fourth reconstruction (A2) and the 1 Ahau 18 Kayab of 9.9.9.16.0 (base A) which is highlighted in the preface. This remainder he supposed to have been the number that was intended for the place actually occupied by 1.5.5.0 in the fourth tier of the preface, and he ventured it as a correction of that number (Thompson 1935: 63-64; 1950: 225, 226).

A mean-error graph for Thompson's sequence of hypothetic bases prior to E has been superimposed (in dotted lines) on the graph of Figure 1. It depicts data drawn from the Tuckerman tables in the same manner as that of Table 3 (though not included there). The sequence misses the only chance that there ever was for a heliacal rising of Venus on a day 1 Ahau 18 Kayab, and it provides no explanation for the large error at the initial terminus or for the precipitous correction (overcorrection) implied by the supposed 1.6.0.0 interval. This entire reconstructed portion of Thompson's sequence must therefore be discarded.

Thompson noted that the final number in the table of the preface (equal to eight calendar rounds) is the distance between the two positions of 1 Ahau 18 Kayab in his chronological sequence; but he considered that "it may be pure coincidence" (1950: 226), and he attached no particular significance to this or to the preceding multiples of the two-calendar-round interval. In the interpretation proposed here, however, these latter have been taken to determine prior Maya-hypothetic bases, in regular progression from the observational base, backward to the one calculated to initiate a supposedly previous Venus-Mars cycle.

2. Teeple (1930). Teeple, in his final treatise (1930: 94-98), made no attempt to link the two 1 Ahau 18 Kayab dates of this series. Rather, he took them to be mutually exclusive alternatives for the primary base of the main table. He posited therefore either the series from base E onward as we have it here, and as Thompson had it, with the base of the table at 10.10.11.12.0, or an alternative analogous series placed eight calendar rounds earlier, with the base at 9.9.9.16.0. One or the other of these he thought (then, 1930) was probably correct. The error graph corresponding to the later placement is the same as that of Figure 1 from base E to the right, with everything to the left of E cut off; that is, provided that the Maya chronology is interpreted by the 584285 correlation, which was the one for which Teeple gave the best arguments and about which he seemed the least pessimistic at that time. Like Thompson's adaptation and extension of it, it misses completely its only chance for a heliacal rising on a day 1 Ahau 18 Kayab and its only chance for a zero error. And it offers no explanation for the 9.9.9.16.0 date or for the problematic interval 1.5.14.4.0. The error graph for the earlier hypothetic placement, assuming

again the same correlation, would be the same graph as from E to H, transposed eight calendar rounds to the left (so as to begin on the abscissa of A) and 20.8 ordinates downward (so as to begin at -15.6). This would place the entire graph between the ordinates -20 and -11, implying errors in that range throughout. Errors of such magnitude are hardly to be expected in a functioning table of this sort, so Teeple (p. 105) proposed interpreting the Landa equation with 20 or 30 days leeway to compensate for it, allowing for that much variation in the correlation in case this should be the required placement of the base. [But a calendrical error of that magnitude in Landa's information is hardly more likely, and the need to impute it is a cause for doubt concerning the interpretation.]

3. Teeple's first interpretation (1926). In Teeple's previous treatment of this subject (1926) he had posited neither of these two series, but instead, one that is placed two calendar rounds later than the earlier of them, thus locating the 1 Ahau 18 Kayab base at 9.14.15.6.0 and the others accordingly; and he reconstructed two hypothetic prior bases, analogous to Thompson's but six calendar rounds earlier, on the assumption that the correction procedure was already in operation. Then he proposed two of what seemed to him at that time to be reasonable possibilities for an astronomically derived calendar correlation (they are equivalent to the constants 492622 and 427803, though he did not express them in those terms). Both of these yield just about an optimum placement of the error graph, with heliacal rising on or within a day of the 1 Ahau 18 Kayab of 9.14.15.6.0 (abscissa B of Figure 1, this representing A.D. 476 January 25 by the first correlation, or A.D. 298 August 9 by the second) and with the range of error magnitudes nicely balanced either side of zero, from -3.8 to +4.2 days. The hypothetic correlations, of course, were chosen expressly to achieve that effect (along also with that of yielding correct moon ages). But they were premised on some other considerations shown later to be wrong, and they took no account of either of the two prime considerations for a historically valid correlation, namely, the Landa equation and the Katun 13 Ahau condition; instead, they yield results that are grossly at variance with these. By the time he wrote his 1930 treatise he had discarded both the chronology and the correlations of this earlier paper. They are of interest, however, for what they illustrate about the nature of the problem and the history of attempts to understand it.

4. Spinden (1928), Schulz (1935), Ludendorff (1937), Dittrich (1937). The heliacal rising of Venus on November 20, A.D. 934, four days after the inferior conjunction of November 16, is the necessary and crucial datum for any interpretation of the Dresden Codex table that is premised on an ascription of its 1 Ahau 18 Kayab base to an observable astronomical event of the prescribed kind, and on a calendar correlation that respects Landa's equation--as do both the Thompson and the Spinden correlations. It is ironic that this date was given no notice by either Teeple or Thompson; for it is the only time in all of Maya history that the cycle of Venus and that of the Maya calendar came together in the required combination. The magnitude of the error at 9.9.9.16.0 by the Thompson correlation should have given the clue to look exactly six calendar rounds later. Spinden, by a fortuitous coincidence, happened onto the date and recognized its property; and it (or rather the day before) became the anchor for his Venus chronology. It was noted also by Schulz (1935), Ludendorff (1937), and Dittrich (1937), and it figured similarly in their interpretations. Both Ludendorff (p. 89) and Dittrich (p. 349) observed that with neither the Thompson nor the Spinden correlation did the problematic 1 Ahau 18 Kayab of

9.9.9.16.0 correspond to a heliacal rising of the morning star as had generally been supposed and as was seemingly implied by its prominent display in the preface and by the place of that calendar-round day in the main table. And Schulz (pp. 58, 66) made a point of the fact that it would be necessary to add six calendar rounds to it when employing the Thompson correlation, or eleven when using the Spinden, in order to reach the only possibility that there ever was for a 1 Ahau 18 Kayab heliacal rising, which was that of November 20, A.D. 934, and which would be Maya 10.5.6.4.0 by the Thompson correlation, or 10.18.9.15.0 by the Spinden. This date he took to be the starting point of the 18 Kayab line of the main table of the Codex. Dittrich (pp. 337-9) gave an elegant derivation of the date and proof of its uniqueness; and he showed that if 9.9.9.16.0 were considered to be the indicated base of the 18 Kayab table, it would require a correlation constant of 698164 (six calendar rounds greater than Thompson's, eleven greater than Spinden's). This, however, he immediately rejected, on the grounds that researches on the correlation problem had already shown that there could be only two acceptable alternatives, five calendar rounds apart, viz. 489384 (Spinden's) and 584284 (an accepted variant of Thompson's). The value 698164 which he derived from equating 9.9.9.16.0 with A.D. 934 November 19 would agree with Landa's equation as well as did the Spinden and the Thompson values, but it would not satisfy the Katun 13 Ahau condition, and it was therefore to be rejected. He concluded that it was necessary to abandon the notion that the table of the codex might have rested on a 1 Ahau 18 Kayab observation of the morning star at horizon prior to A.D. 934. This meant that the 9.9.9.16.0 date that was highlighted in the preface to the Venus table (which he took to be the base of the main table) would require some explanation other than the supposed observational one.

The chronology of the historical bases (D to H) as posited by these writers was thus essentially in agreement with the one that is proposed in this paper when interpreted in terms of the European calendar. When interpreted in terms of Mayan chronology however, it is something quite different. Spinden's placements of the bases D through H (as labeled here) are just one day earlier in Christian chronology; but they are five calendar rounds later in the Maya longcount. A mean-error graph for his scheme would be like ours from D through H, but with all error values (the ordinates) reduced by a day, and with the abscissas differently interpreted in Mayan chronology, though not in European. The Maya 9.9.9.16.0 abscissa would be five calendar rounds further removed from base D (two and a half blocks further to the left), and the ordinate of its 'error' at that point would have to be found several feet off the lower edge of the page. (The difference is an odd number of calendar rounds; which removes the date far from any inferior conjunction or heliacal rising. It is instead about 28 days before a superior conjunction.) Spinden did not comment specifically on base E, but its position is implied by those of D and F. For base H he mentioned three alternatives, at intervals of two calendar rounds, the first approximating a final heliacal setting of the evening star, the second an inferior conjunction, and the third a heliacal rising of the morning star. It is the last of these that is in agreement with ours, and that conforms to the specification of a base. [The one-day differences are due to his interpretation of the Puuc-style Maya date in the Landa equation (12 Kan 1 Pop = A.D. 1553 July 16, O.S.) as representing Classic 12 Kan 2 Pop rather than 11 Akbal 1 Pop.]

Schulz outlined two alternative chronologies for the same sequence of

bases, both of them--but for a single item--agreeing with ours in their assignments of bases to European chronology, and one of them agreeing also in its Mayan placements; while the other agrees, again with that exception, with Spinden's. The first of Schulz's alternatives thus represents a historical precedent for the chronological interpretation offered in this present paper, though the Mars conjunction with Venus on the crucial date was not noted by him and did not figure in his determination. An unfavorable judgment on his part as to the likelihood of survival of knowledge of the longcount into the period covered by the Venus table (A.D. 934-1324) led him (p. 59) specifically to exclude the possibility that the date 9.9.9.16.0 might be explainable as a calculated backward projection from the date of the historical base of the table, namely, A.D. 934 November 20 (10.5.6.4.0 by the Thompson correlation, 10.18.9.15.0 by the Spinden). He took it rather to have been a forward projection from Old Empire times, one that was preserved--for a reason unstated--for utilization in a later period. [It would thus have to be seen as an early Classic Maya prediction that came true only six, or eleven, calendar rounds late.] But for this judgment and its consequence, and the absence of the Mars datum, and the exception referred to above (namely, his placement of the 13 Mac base two calendar rounds too early, 6.9.0 before 18 Uo!), Schulz's first alternative would have been the same as that proposed here. As it was, however, it lacked satisfactory explanation of either the date 9.9.9.16.0 or the interval 1.5.14.4.0.

5. Makemson (1943, 1946). In her earlier treatment of this subject Makemson accepted the validity of the Landa year-bearer equation; took note of Dittrich's proof of the uniqueness of the 934 November 20 identification of a Venus heliacal rising with a Maya day 1 Ahau 18 Kayab (assuming the Landa equation to be correct); acknowledged the four successive bases determined by the top tier of numbers in the Venus table preface as possibilities for its assignment; and on the basis of an assumption of contemporaneity of the 13 Mac line of the main Venus table (which she showed to be the current line) with the particular rerun of the eclipse table that would have its nodes agreeing with their locations in the table, she determined that the 934 November 20 event must be identified with the 1 Ahau 18 Kayab of 10.5.6.4.0. This result, she noted, "may be added to the mounting sum of confirmations of the Goodman-Thompson correlation." She noted also that "If ... 10.5.6.4.0 represents a heliacal rising of Venus, it follows that 9.9.9.16.0 must place the planet 16 days before heliacal rising, and the reverse is also true." Further, she took note of the Mars conjunction with Venus on the 10.5.6.4.0 heliacal-rising date, and the role that this must have had in the backward numerical projections to 9.9.9.16.0 and -6.2.0. Her results were thus in agreement with those to which I have been led, by a somewhat different route, starting with 10.5.6.4.0 (base D) and proceeding backwards; but proceeding forwards they disagree. The final 18 Kayab base (E) is missing in her scheme, the 18 Uo base (F) is unaccounted for, and those that follow--13 Mac, and 3 Xul (G and H)--fall two calendar rounds earlier. This discrepancy results from her assumption of close contemporaneity of the Venus table and the eclipse table, her somewhat early placement of the latter, and a different manner of judging the currency of any given version of the table. It has the consequence of providing no explanation for the problematic number 1.5.14.4.0 in the fourth tier of the table of the preface, which she did not take into consideration. This, as noted earlier, is equal to the sum of eight calendar rounds and 4.12.8.0 (i.e., four complete runs of the main table plus one doubly foreshortened run), and it derives the 18 Uo base

from the 18 Kayab base of 9.9.9.16.0. In ignoring this, her placement of the remaining bases fails to conform to the prescriptions of the preface.

That was 1943. In 1946 she abandoned all that, or at least the most essential parts of it, and went on to propose a new correlation. A part of the reason had to do with that very number, 1.5.14.4.0, that had been bypassed in her earlier presentation. Though it did not figure in that publication, it had not been absent from her thinking about the matter; for she later wrote (1946: 58-59) that at the time she had been struck by the curious fact that the excess of that number over 317 mean Venus periods was exactly right for removing the discrepancy of -17.6 days between 9.9.9.16.0 and the time of heliacal rising as given by the Thompson correlation, and that it had seemed to her then that the number must have been computed for that very purpose. This, she noted, was equivalent to saying that 9.9.9.16.0 was not intended to represent a heliacal rising at all, but was chosen for some other purpose. She submitted her theory to Thompson before publication, but according to her testimony he was not convinced by her argument either for this notion or for the Mars connection, and: "He maintained that the Maya date was clearly intended as the epoch of the ephemeris and a heliacal rising of Venus." Concerning this she then commented: "But if 9.9.9.16.0 represents a heliacal rising of Venus, a fresh problem arises with regard to the Goodman-Thompson correlation, [namely] how it came about that an error of -17.6 days is found, when the cumulative error of the ephemeris is always in a positive direction." This is yet another aspect of the problem to which Thompson made reference (as quoted earlier in this paper) but for which he offered no solution. He only bypassed it by adding the invented figure of 1.6.0.0 to the date in order to find a new base from which to proceed.

Makemson was very close to an astronomically as well as logically satisfactory resolution of the entire problem within a chronological framework compatible with the Thompson correlation. Had she insisted on her suspicion about the fictitious nature of the 9.9.9.16.0 date, and had she been willing to accept also the remaining implications of the 1.5.14.4.0 interval, her conclusions and her chronology would have been the same as those that have been proposed in this paper. Instead, by the time she wrote her 1946 monograph she had embarked on a survey of possible correlations such as might be deducible from astronomical evidence alone, deciding not to be bound by the constraints of the Landa equation, about which she had developed doubts. And she followed up her deduction that "a correlation which represents the Maya date [9.9.9.16.0] with a positive error should be given more weight than one which places [it] an equal number of days before heliacal rising," as does Thompson's. In this she was abandoning her former hypothesis, to which Thompson had objected, that 9.9.9.16.0 was a computed projection into the past, and that this accounted for the negative error at that date. In its place she was now substituting a hypothesis that 9.9.9.16.0 was a forward projection from a table already in use before that date, which would then make positive errors expectable. The correlation that she found--the only one from her survey to fulfill that condition, along with meeting other astronomical and historical requirements (not including the Landa testimony however)--ended up differing from the Spinden correlation by just 246 days (with correlation constant equal to 489138, Spinden's being 489384). Her further arguments in support of this interpretation (speculations about seasonal relevance of Maya rituals) will not be considered here, except to note that they are wide of the mark.

Conclusion

After having completed the main part of this paper, in which I presented the results of my own inquiry, and turning then to a review of previous interpretations of the problem--and after finishing with those of Teeple and Thompson and going on to those with which I had been only slightly if at all acquainted--I found myself in the not unfamiliar circumstance of having discovered things that others had discovered long before; in this case, the date A.D. 934 November 20, the uniqueness of the combination of calendrical and astronomical events of that date, and their signal importance. Under most such circumstances that would have left me without a paper; but not quite this time. Although crucial pieces of the puzzle had been located and identified earlier, their proper assembly has remained incomplete to the present time. So also has their full documentation.

Spinden was the first to discover the crucial date. His interpretation for the period covered by the historical dates was essentially correct on the astronomical and European-calendrical side, but it was five calendar rounds off on the Mayan side of the equation. Since this is an odd number of calendar rounds while the multiples that are compatible with the Venus period are even, this left the important date of 9.9.9.16.0 off in limbo before superior conjunction and without an explanation. Spinden made only the briefest of reference to it, noting that by his correlation it would fall (in A.D. 363) on April 12 in retroactive Gregorian dating, a seasonal position to which he attached importance (he associated it with the 19 Xul heliacal risings, those next prior to 18 Kayab).

Schulz, when considering the possibilities under the Spinden correlation, observed (1935: 66): "By the Spinden correlation the date 9.9.9.16.0 relates to the superior conjunction of Venus (besides which its position in the tropical year is of course to be taken into consideration)." The codex, however, clearly sets it up for a first visibility of the morning star, four days after <u>inferior</u> conjunction. [The Spinden equivalent of this date, A.D. 363 April 11 (Julian) or 12 (Gregorian), was actually a good possibility for a <u>last</u> visibility of the morning star. But that is not what the context in the codex calls for.]

It was left to Dittrich to contrive a rationale for that date under the Spinden correlation. Noting first that it could not represent an actual heliacal rising, he took it to be a cipher of sorts, as if it were a secret code. He considered the 19 Xul and the 18 Kayab heliacal-rising dates (April and November in the mid-tenth century) to be the more reliable ones, and he concluded (p. 349): "If one wanted to camouflage the date of the epoch, the natural thing to do would be to declare, instead of the November base, an April one. The initiate would of course know that the date should be moved forward into the future by the amount that it would take to cause the day 1 Ahau 18 Kayab to fall in November." How much would that be? The drift of the <u>haab</u> within the tropical year amounts to about 12.6 days per calendar round [(365.2422 - 365) x 52 = 12.5944.] The interval from November 24 (the Gregorian date of 1 Ahau 18 Kayab in A.D. 934) to April 12 (its proposed mask) is 139 days. 139 divided by 12.6 is equal to 11 and a small fraction. The hidden interval must therefore be eleven calendar rounds! And so the initiate could derive the true epoch from the publicly declared false one: 9.9.9.16.0 (1 Ahau 18 Kayab) + 1.8.19.17.0 (11 CR) = 10.18.9.15.0 (1 Ahau 18 Kayab), this latter being the

longcount equivalent of A.D. 934 November 19 (Julian), or November 24 (Gregorian), by the Spinden correlation [5 CR further along than its 10.5.6.4.0 counterpart by the Thompson].

This remarkable hypothesis is the best that could be done by way of the Spinden correlation for the date that is the frontispiece of the Dresden Codex Venus table and that had to be allowed to stand (one way or another!) for a heliacal rising of the morning star.

Makemson, in her second attack on the problem, and going over to a Spinden-like correlation (i.e., with a 12.9.0.0.0 rather than an 11.16.0.0.0 Katun "13 Ahau"), attempted to remedy this inherent discrepancy by cutting 246 days off from the Spinden correlation constant; but in so doing, she had to discard the historical underpinning of that correlation (which it shared with Thompson's) in the Landa year-bearer equation.

The discrepancy in 9.9.9.16.0 was of lesser numerical magnitude under the terms of the Thompson correlation, but the logical dimensions of the problem were not appreciably less. Schulz and Makemson, when they were entertaining the possibility of that correlation, came the closest to a solution; but for reasons already reviewed each fell short of attaining it. Teeple and Thompson were still farther from it, having failed even to recognize the historical date that offered the only possibility ever for an articulation of the 1 Ahau 18 Kayab position of the Maya calendrical cycle with the heliacal-rising position in the astronomical Venus cycle.

The refractory pieces of this puzzle have been the 9.9.9.16.0 longcount date, which is given a very special treatment in the Venus table preface but which has been difficult to relate to the apparently intended phenomenon of Venus, and the number 1.5.14.4.0, which on the face of it seems incongruously composed and whose function in the table's chronology and correction procedure has been obscure. As noted earlier, these two items have posed for many scholars an obstacle in the way of their acceptance of the Thompson correlation. The solution that has been described here provides the necessary explanations for both of them. It differs only slightly from what Schulz outlined as possibilities under the Thompson correlation, or from what Makemson proposed under that correlation in her first study; but those differences are crucial. It offers support, moreover, for the Thompson correlation. Strong support for that correlation, it may be noted, has been found also in Venus-related dates from Classic Maya inscriptions at several sites. The apparent pertinence of some of those dates to Venus was first shown by Kelley (see Kelley and Kerr 1973, and Kelley 1977), and their compatibility with astronomical chronology when interpreted by the Thompson correlation I have shown in another paper (1982).

The validity of Thompson's correlation derives from the historical document on which it was founded (see Thompson 1927, 1935), a document whose evidence has been unwelcome to some, and which they have tried to explain away. The Venus chronology now is corroborative, as has been lunar chronology from the beginning. The problem of the Dresden Codex Venus table can no longer be held against the correlation. Rather, it may be seen now as a type case illustrating that reputed failures of this correlation may derive not from wrongness of the correlation, but from faulty analyses of some of the problems to which it has been applied.

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JOHN B. CARLSON

The Grolier Codex: A Preliminary Report on the Content and Authenticity of a Thirteenth-Century Maya Venus Almanac

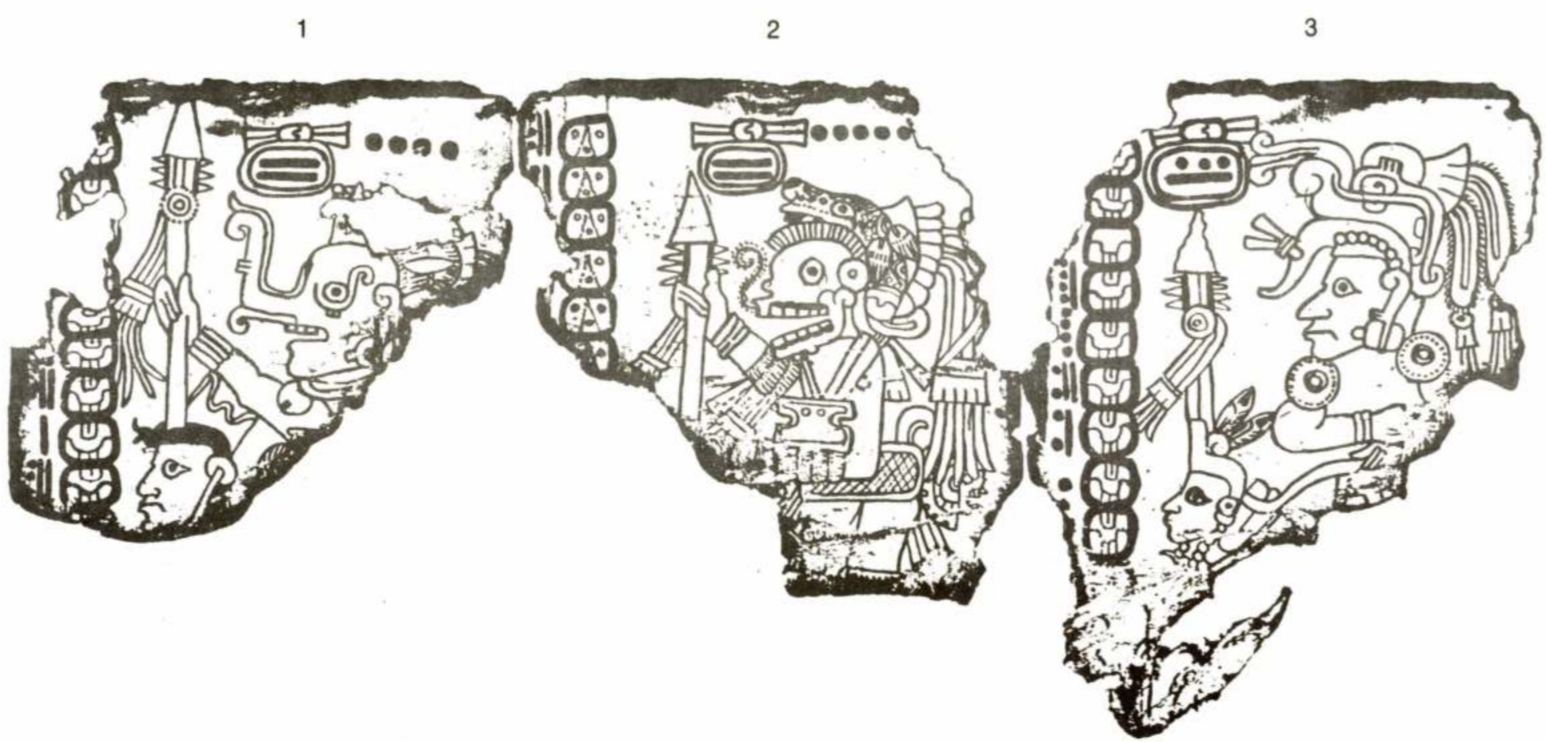
The Maya civilization of eastern Mesoamerica attained the highest levels of literacy in the pre-Hispanic New World. It is known that the Maya of the Classic Period (ca. A.D. 250-900) possessed screenfold "codex" books painted on stuccoed bark paper because there are depictions of them on Classic Maya pottery, and decomposed examples have been found in burials. Regrettably, none of these Classic codices is known to have survived. The major source of Classic texts is the monumental inscriptions carved on stone and wood and painted on stucco murals.

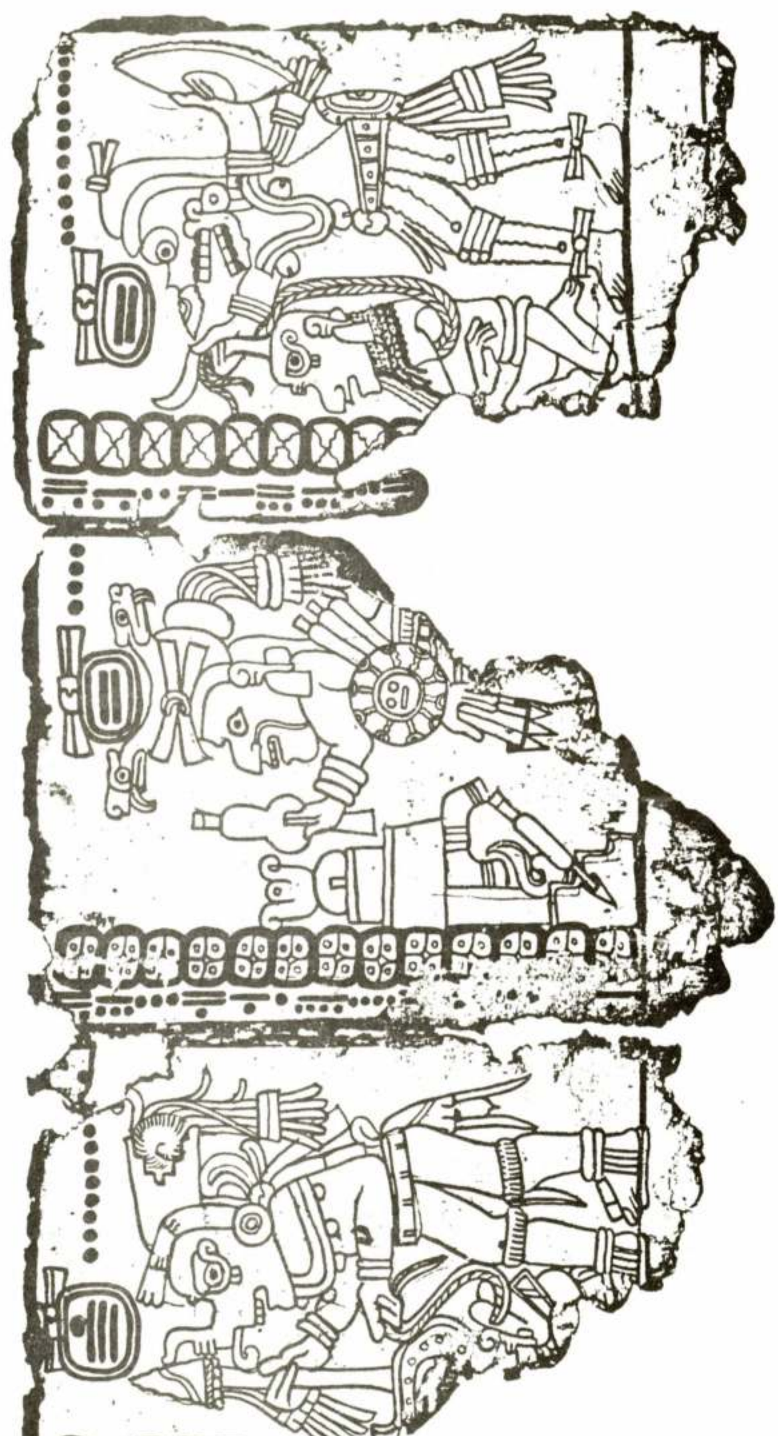
We are most fortunate, however, that four Maya codex books from the Post-Classic Period (ca. A.D. 900-1520) did survive the destructive forces of time and the Spanish conquest. Three of these, the Dresden, Madrid and Paris Codices (named for the European cities whose libraries house them) have long been recognised as Maya manuscripts. However, their exact proveniences and how and when they came to Europe are not known.

A fourth screenfold codex containing Maya day glyphs appeared in 1966 in the hands of Dr. Josué Saénz, a collector of pre-Columbian art in Mexico, along with several other extraordinary Maya artifacts also composed a perishable materials (Meyer 1973:ch.1). As are the other three Maya books, this codex was painted on bark paper coated with white stucco. Unlike the others, however, only the obverse is painted and it possesses a number of non-Maya "peculiarities" in content and style. The unusual style and uncertainties of provenience have caused at least a few well-known Maya scholars, such as Sir Eric Thompson (1975) to suggest, if not insist, that the fourth Maya codex is a modern fabrication.

According to the most reliable accounts (M.D. Coe, personal communication; see also Meyer 1973:ch.1), Josué Saénz obtained the 11-page codex fragment along with three pieces of unstuccoed paper, a turquoise inlaid mask, a beautifully carved small wooden box, a sacrificial knife, and several other items from looters or their representatives at a jungle airstrip, probably in the state of Chiapas. The cache was allegedly found in a large wooden box in a dry cave. The mask, now generally accepted as authentic, is on display in the Dumbarton Oaks Collection in Washington, D.C. (see von Winning 1968:pl.333). The carved box with Maya inscriptions, also authenticated, has been described in detail by Coe (1974). It is an important consideration that these two artifacts of perishable materials, both authentic and of exceptional quality, allegedly appeared together with the equally perishable codex fragment. This would tend to support the truth of the story of the cache in the dry cave. The alternative would be to suggest that the huaqueros found

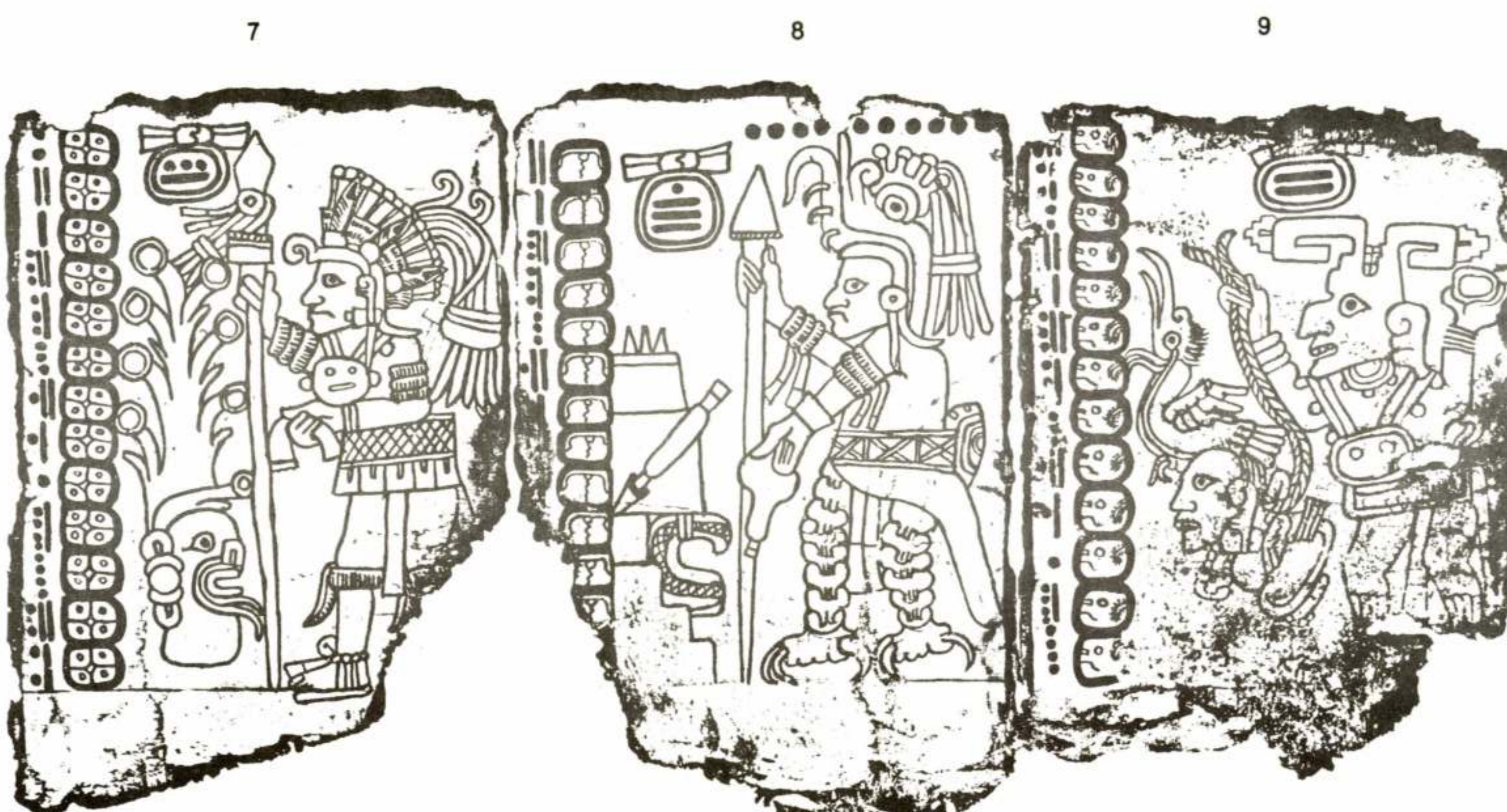
Figure 1 A black-and-white reproduction of the color facsimile of the 11-page Grolier Codex, published by Coe (1973).



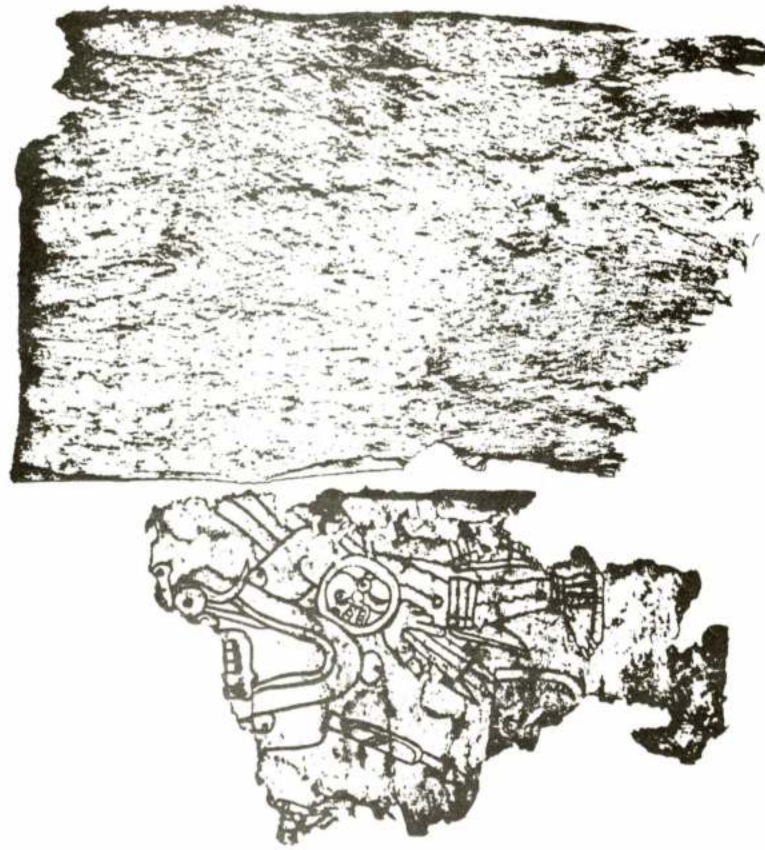


4 5 6

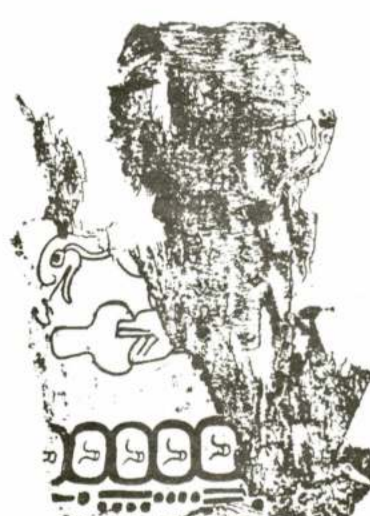
Figure 1 The Grolier Codex



11



10



two (or more) genuine, rare pre-Columbian pieces (perhaps from different sources) and then included a faked codex with them.

The Grolier Codex - A Maya Venus Almanac

The codex first gained public and professional attention on April 20th, 1971 when its existence was announced by Michael D. Coe at the opening of an exhibition entitled "Ancient Maya Calligraphy" sponsored by the Grolier Club of New York. The next day an article by George Gent (1971:49) appeared in the New York Times showing pages 4 through 7 of the "Grolier Codex". Although it has also been known as Codex Saénz and Codex Coe, it was given the name "Grolier Codex" by Coe (1973) in the published catalogue of the Grolier Club Exhibition. This handsome oversized volume, The Maya Scribe and His World, contains the only published facsimile along with Coe's analysis and page by page commentary. A black and white copy of this color facsimile is reproduced here as Figure 1. The original codex has approximate dimensions of 18.0 cm for the greatest height of a page; the average width is 12.5 cm. Coe's facsimile reproduces the eleven fragmentary pages slightly greater than half size, followed by one of three blank sheets of bark paper found with the codex. As reported in the Maya Scribe (Coe 1973:150), a piece of this unpainted bark paper yielded a radiocarbon date of A.D. 1230 ± 130. It is now generally conceded that the paper itself is genuine thirteenth century Mesoamerican paper. However, a question has remained in some minds as to whether the Grolier Codex is a genuine Maya book or a modern forgery on ancient paper.

From the first revelation of its existence, several Mayanists independently reached the conclusion that the Grolier Codex is a fragment of a Venus almanac with the same basic calendrical structure as that found in the twelfth-century Maya Dresden Codex (see Figure 2 and Table 2). Venus, the second planet from the Sun with an orbit interior to that of the Earth, exhibits a Morning Star/Evening Star manifestation. The Maya astronomers knew that Morning and Evening Star were both aspects of the same entity and were able to observe that the full cycle of Venus was 584 days. This is quite close to the true average value of the synodic period of Venus, 583.92 days. From the Dresden Codex Venus tables, we know that the Maya divided the full Venus cycle of 584 days into four stations with the following canonical durations: (1) Morning Star (235 days); (2) disappearance and invisibility at Superior Conjunction (90 days); (3) Evening Star (250 days); and (4) disappearance and invisibility at Inferior Conjunction (8 days). Also from the Dresden Codex, as well as from ethnohistoric and ethnographic accounts throughout Mesoamerica, we are led to believe that Venus was seen as a fearsome, death-dealing entity associated with dire prognostications. In particular, the heliacal rising of the Morning Star is singled out in these accounts for special perils. The first appearance in the east of the Venus God Tlahuizcalpantecuhtli, "Lord of the House of Dawn" (an aspect of Quetzalcoatl, the "plumed serpent") was occasioned by deadly spearing rays. Mesoamerican Venus imagery shows malevolent deities wielding spears and launching atlatl darts into their unfortunate victims (see Seler 1904).

The Maya calendrical astronomers were always keen to commensurate and coordinate the cycles of time and numbers that they found significant in order to create even greater periods. The Mesoamerican "Calendar Round" of 18,980 days is composed of 52 of their 365-days "Vague Years" and 73 of their all-important 260-day "Sacred Almanacs". If we further require that the 584-day Venus period commensurate with the 365-day year and the 260-day almanac, a grand Venus Calendar of 37,960 days is created which is exactly two Calendar Rounds, a period composed of 65 Venus cycles, 104 vague years, and 146 Sacred Almanacs. This is the calendrical basis for the Venus calendars found in both the Dresden and Grolier Codices.

The Dresden Codex Venus Almanac

Figure 2 contains black and white drawing of the six Venus pages of the Dresden Codex with the calendrical notations transcribed in Table 2. Page 24, which provides a scheme to maintain long-term agreement between the almanac and astronomical reality and place it in the time frame of the Maya Long Count,will not be discussed here as no such table was found with the Grolier Codex. The Dresden Venus Almanac itself is five pages, numbered 46 through 50. Each of these five pages is one Venus cycle of 548 days. The left side of each page is divided into four columns giving the calendrical dates, reading from left to right, for disappearance before Superior Conjunction, first appearance as Evening Star in the West, disappearance before Inferior Conjunction and heliacal rise as Morning Star in the east, respectively. The right side of each page shows events related to the heliacal rise of some sort. The central image is a Venus deity in the act of spearing a victim depicted below. The associated glyphic texts relate to these images and contain dire prognostications associated with the first appearance of Venus as Morning star.

The Dresden Venus Almanac contains five pages-- as do similar Venus almanacs in the pre-columbian "Borgia Group":Cospi,Vaticanus B and Borgia codices (Seler 1904) -- because of a fortuitous astronomical coincidence. As it happens, five Venus periods of 584 days exactly equal eight Maya Vague Years of 365 days. Thus, following this 2,920-day period, Venus will return to the same calendrical position relative to the solar year. This is the basis of the 104-year grand cycle described above, because if we repeat these five pages thirteen times we achieve the additional commensuration with the 260-day Almanac. At the upper left of each Venus Almanac page are groups of Maya day signs with coefficients in rows of four and columns of 13. These are the dates of days reached by Venus in the 260-day Almanac at each of the four stations. To read the tables, we proceed to the top line from left to right through each of the five pages (eight years total) and then back to the first page and begin on the second line and repeat until all thirteen passagesare complete. This is the 104-year great Venus century of the Maya. More detailed discussions of these pages in the Dresden Codex may be found in the commentaries of Thompson (1972) and Lounsbury (1978).

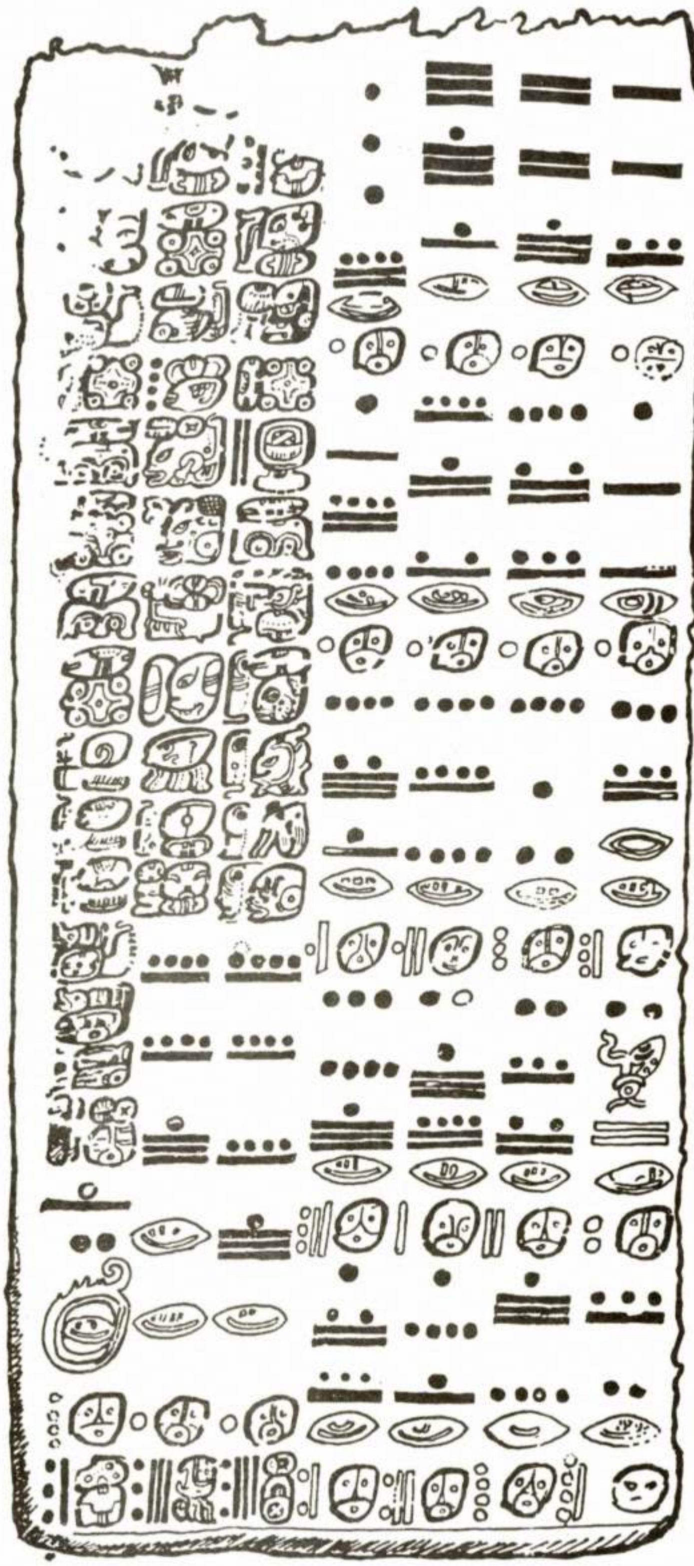


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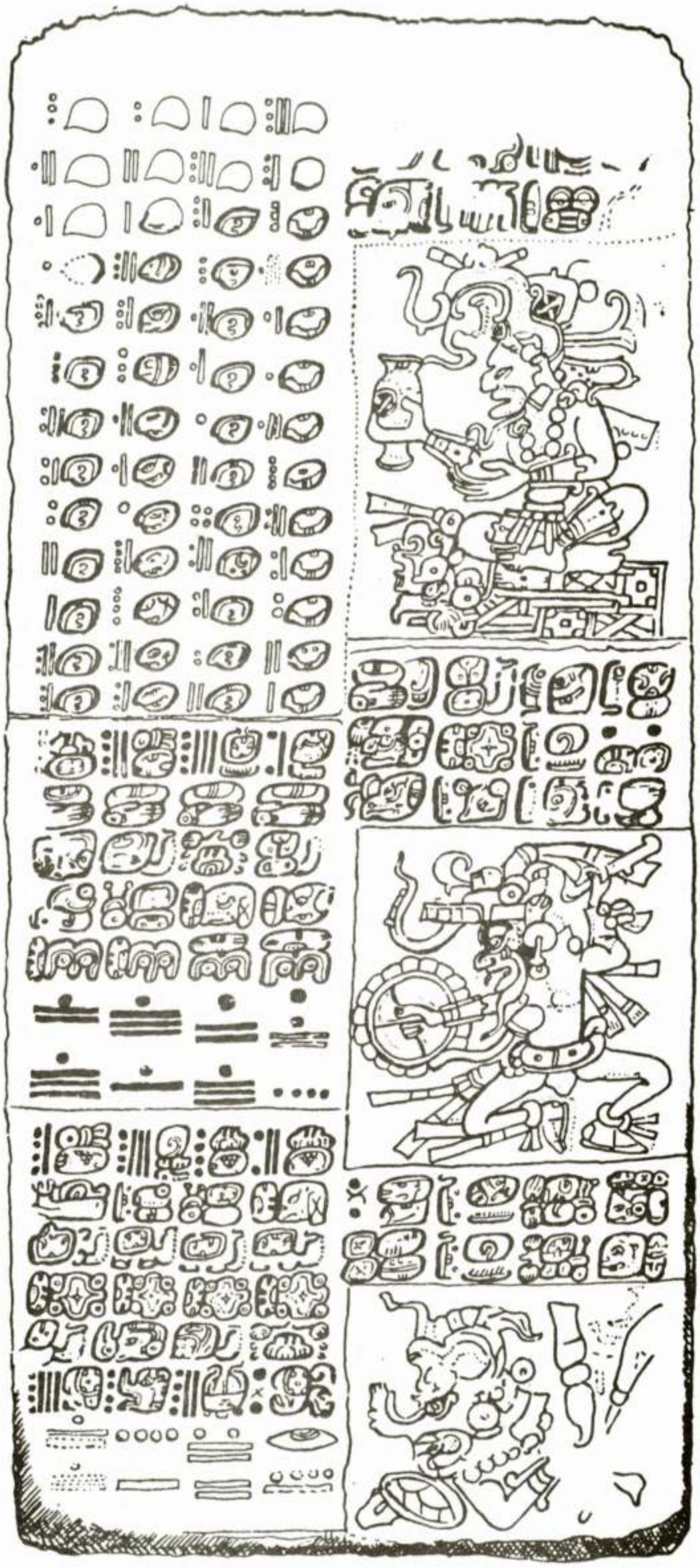
Figure 2 The Venus Almanac pages of the Dresden Codex (1975). These are pen-and-ink drawings originally made by Carlos A. Villacorta and corrected by Ferdinand Anders.



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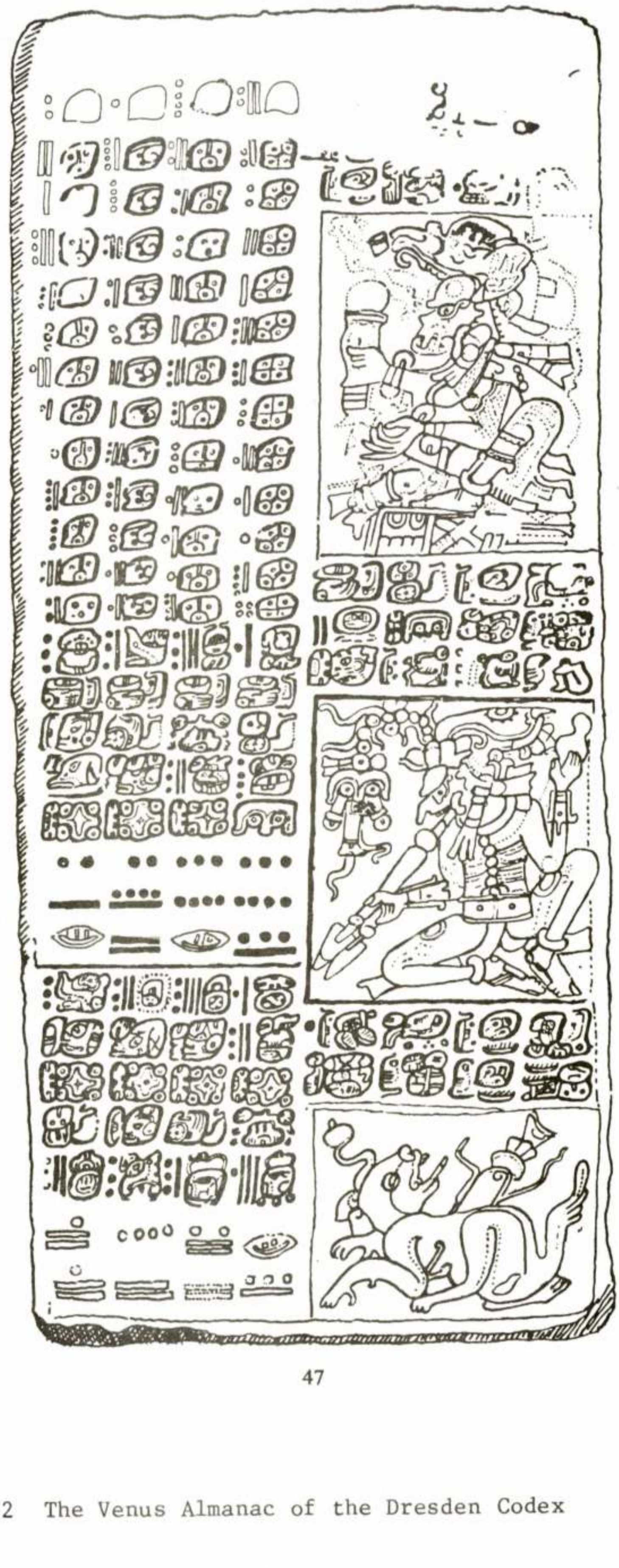

Figure 2 The Venus Almanac of the Dresden Codex

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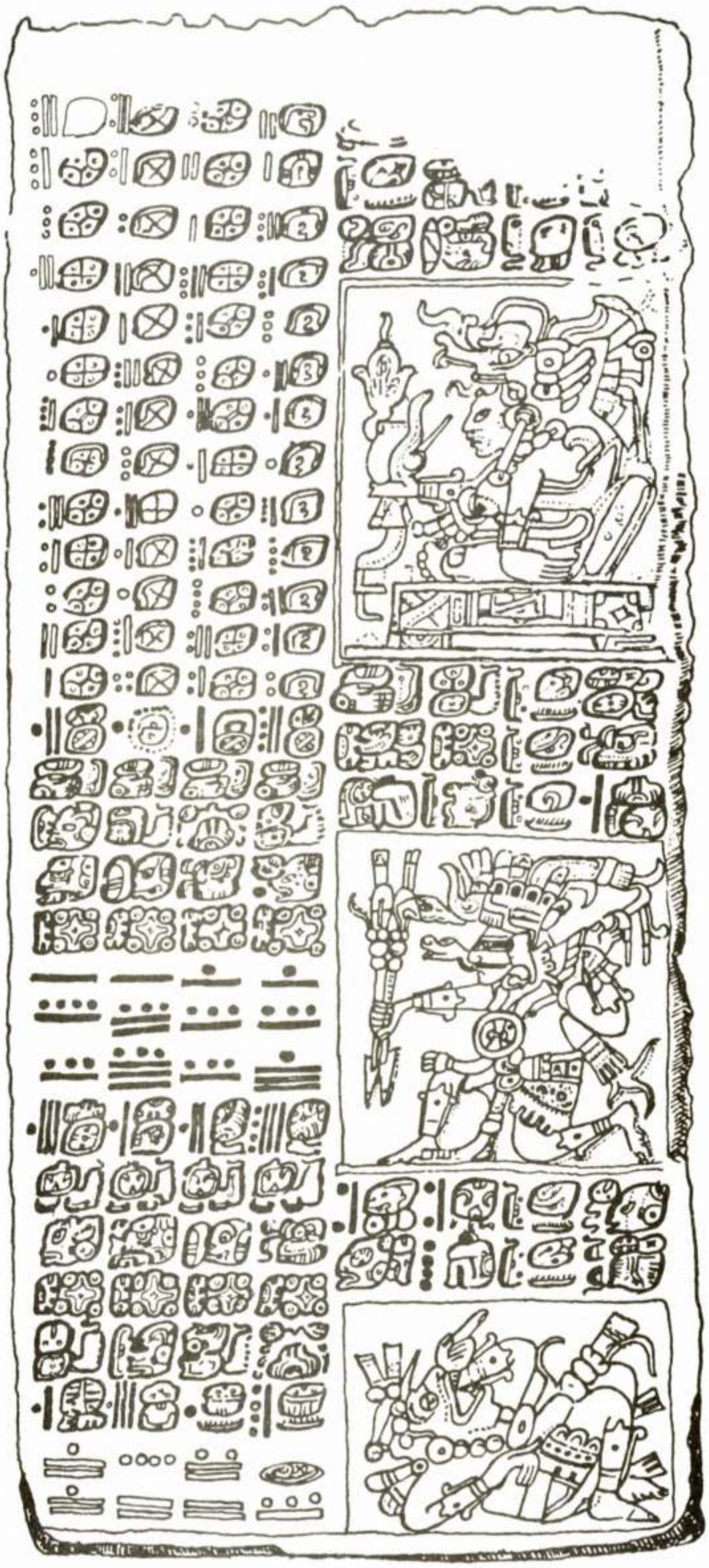

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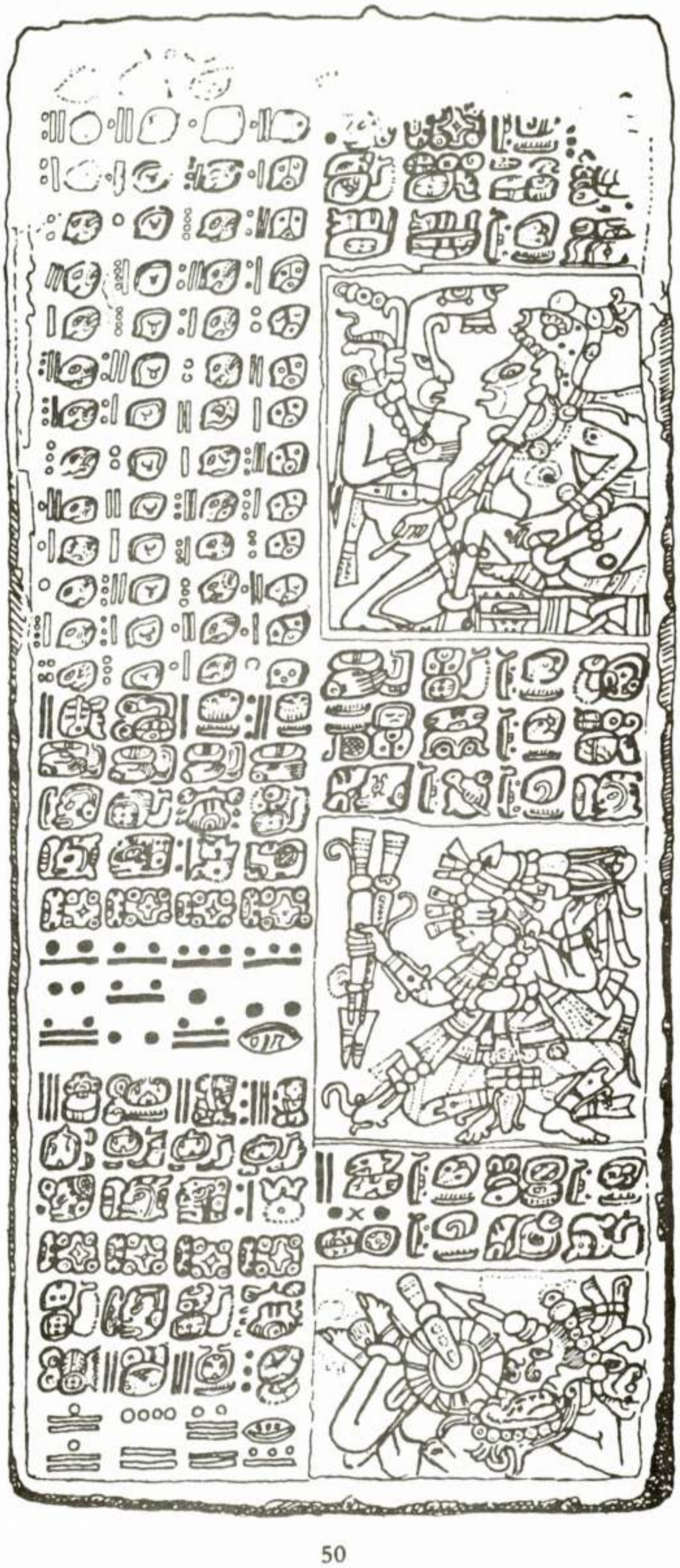
Figure 2 The Venus Almanac of the Dresden Codex



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The Dresden and Grolier Venus Almanacs -- A Comparison

When we look at the Grolier Codex (Figure 1) we see on the left of each page (with the exception of page 11) a column of what were originally 13 Maya 260-day Almanac dates that match precisely the four columns of dates on Dresden pages 48 and 49 and the first two columns on page 50. Thus, where each Dresden page represents one Venus cycle of 584 days, each Grolier page is one Venus station. Since four Grolier pages correspond to one Dresden page, the Grolier Codex must have originally contained a Venus almanac of 20 pages of which seemingly 11 pages have survived. Table 1, taken from Coe (1973:160) shows the Maya great Venus cycle from the Dresden Codex with a shaded area indicating the overlapping calendrics of the Grolier. Grolier page 11 was not included because, being fragmentary and lacking the calendrical dates, Coe was unable to place it in the sequence. If by chance the Codex had been complete when found, we might yet hope to find the additional pages or fragments at a later date.

The pictorial content of the Grolier shows what few would dispute as characteristic Mesoamerican Venus iconography. Standing personages are seen to be armed with spears, atlatls, sacrificial blades, and in one case (p.9) a stone. In these aggressive poses, they dominate bound captives, decapitate a victim (p.6) or sling atlatl darts into temples (pp.5,8) -- a Mesoamerican symbol for conquest. Coe (1973) gives a page-by-page commentary with tentative identifications of several of these standing figures, e.g. The Death God (God A) on page 6 and Maize God (God E) on page 9. He also notes that 20 different deities are named in the Dresden Codex, one for each Venus station, listed on row 17 across the five pages of the Almanac (See Table 2). Thompson (1972) labelled these Deities A through T, and this sequence is also given in Table 1. Each personage named also has a directional association (on line 16), namely A (north), B (west), C (south), D (east), etc. Oddly enough, this same pattern of god names is listed again on lines 21 (for pages D46 and D47) continuing on line 22 (for pages D48 through D50). The directional associations maintain the same relationship on line 24 as before, however, the whole pattern is shifted for this second sequence to one station ahead, i.e. starting with Deity T, A, B, C, etc. up to Deity S for the last column of page D50. The reason for this shift seems clear. For example, on Dresden page 49 column a (equivalent to Grolier page 5), the column of Lamat dates indicate a deity (Dresden Deity M) presiding over the event of disappearance of the Morning Star before Superior Conjunction. Also in column D49a, line 19, the cummulative number of 1988 elapsed days from the beginning of the almanac on page D46 is listed. If this deity's influence is not limited to the Venus event itself on the given day, but extends over the subsequent period up until the next station is reached, this shift would be a method of recording the duration of the influence over that following period. In our example here, the duration of invisibility at Superior Conjunction is canonically 90 days. This 90-day figure is listed at the bottom of Dresden column 49b on line 26 close to the Deity M glyph of the second sequence on line 22. The 90-days when added to the 1988-day cummulative total in column D49a, line 19, gives a new total, 2078 days, given in D49b line 19. The period of invisibility ended, Venus

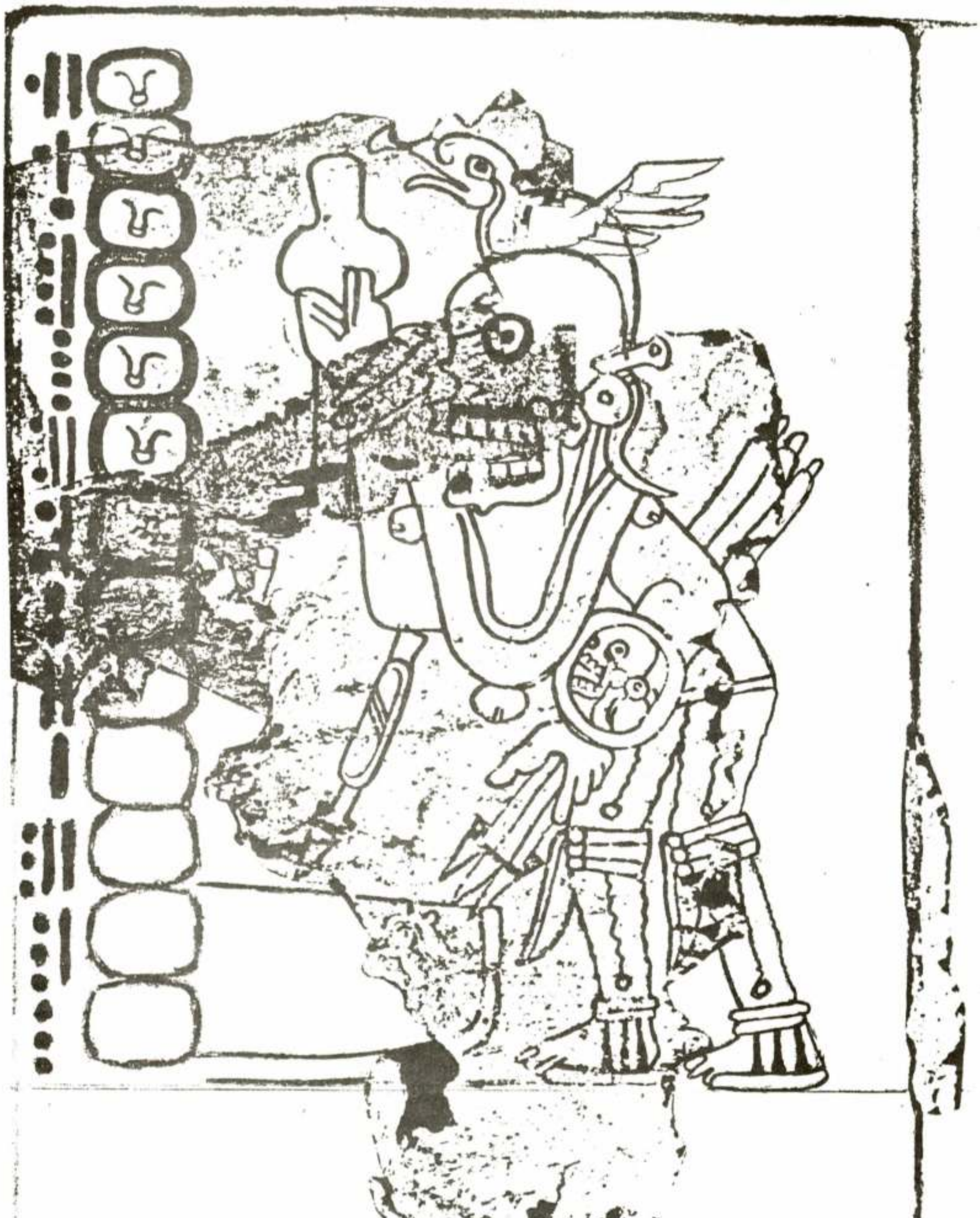
reappears as Evening Star in the west reaching the Etz'nab days with the new Dresden Deity N presiding over the event. The west/Deity N event is duely recorded at column position 16, 17 in the first deity sequence of D49b where it belongs.

The preceeding lengthy exposition was given because it helps us to understand the unique though parallel system in the Grolier almanac. As indicated above, Dresden column D49a corresponds to Grolier page 5 and D49b to G6. In both cases, the first Venus station is the disappearance of the Morning Star before the period of invisibility at Superior Conjunction on a Lamat day. Ninety days must be added to this day to reach reappearance as Evening Star on an Etz'nab day. On Grolier page 5, these 90 days are written in an unusual form above the two-headed serpent headdress of the standing figure, which is probably the Grolier version of Dresden Deity M. Two black bars for the Maya number 10 are contained in a red-painted, tied bundle, creating a so-called "ring number". To the right of this are four red dots. In the vigesimal system, each of the four dots counts for one group of twenty and, with the two bars representing the number 10, a total of 90 days is indicated. There are several known Maya uses for ring numbers, but they usually indicate a step back in time. In this case, the ring number of 90 days, when added to the Lamat date to the left, will reach the Etz'nab date on the next page. This was the day for the seating of the Death God depicted -- the potential Grolier version of Dresden Deity N. Just as in the Dresden Codex scheme, these Grolier figures preside over a given Venus event and also relate to the subsequent duration of time until Venus reaches the next station. The Grolier ring numbers function the same way on each page, but with an additional peculiarity. Within the ring bundle, the numbers are always formed in standard Maya bar-and-dot fashion with a maximum of 4 dots. However, for the red numbers to the right that count groups of twenty days, we see strings with as many as 12 dots and no bars appear. The creation of numbers greater than 4 using strings of dots is not a Maya characteristic; it comes essentially from the Mixtec tradition of counting.

Though style will not be discussed in this paper, the Grolier is not a "purely" Maya book when compared to the other three codices. It is clearly a hybrid showing the influence, broadly speaking, of what has been called the Mixteca-Puebla style. The influence of this style was extensive throughout much of Mesoamerica in the Post-Classic Period. Though Eric Thompson (1975) rejected the authenticity of the Grolier Codex largely on stylistic grounds, I would suggest that the Grolier is just the sort of codex one would expect to find in thirteenth-century Mesoamerica from the Post-Classic Maya boundary areas such as Chiapas, the Gulf Coast, and across the lower Yucatan peninsular to Belize and the east coast of Quintana Roo. The iconography and style of the Grolier relate remarkably closely to that found along the east coast of the Yucatan peninsular. A recent study by Arthur Miller (1982) of the murals of Tancah and Tulum contains images strikingly similar in style to those found in the Grolier. It is also significant that most of this material was discovered recently and was thus largely unavailable to any potential faker in 1966. The details of these

Grolier page 9

Figure 3 A black-and-white reproduction of the Grolier Codex p.9 with the preliminary reconstruction by J.B. Carlson of p. 10/11.



Grolier page 10/11

arguments, together with a careful critique of Thompson's (1975) points of refutation will be presented in an expanded study to be published by Dumbarton Oaks.

To return briefly to the question of the possible relationships between the deities named in the Dresden sequence and those figures shown in the Grolier, in only two cases is there a clear-cut correspondence. Dresden Deity N has a recognisable glyphic name. It is Schellhas' God A, the Death God, which is clearly depicted with its collar of "death eyes" on the appropriate Grolier page 6. Dresden Deity Q is the Maize God, Schellhas' God E, and a good case can be made that this is the figure correctly shown on Grolier page 9. It is difficult to know if we should expect more detailed correspondences. The Dresden and Grolier Codices are stylistically very different and probably come from opposite corners of the Maya region, e.g. the Dresden Codex probably derives from northern Yucatan, perhaps even Chichen Itza. On the other hand, it is equally difficult to imagine why a faker sophisticated enough to create the Grolier Codex in the 1960s would not put in more detailed correspondences, such as, for example, Dresden Deity I from D48a, which is the Maya Sun God, (Schellhas' God G).

The Authenticity of the Grolier Codex -- New Evidence

The essential clinching argument for the authenticity of the Grolier Codex is that it contains information that could not possibly have been known to a potential faker in the early 1960s. This evidence comes from the recent work of Floyd Lounsbury (1982) who has discovered Venus-related and timed events in the Classic Maya inscriptions -- events that are battles or raids apparently initiated for the purposes of obtaining captives for subjugation or sacrifice. However, before pursuing the significance of this discovery to the content of the Grolier, we must first examine the sequence of macabre figures found on Grolier pages 2, 6 and -- as we will show -- on page 10.

While working on the iconography of the Grolier Codex and other Venus tables during the summer of 1982 as a member of the Dumbarton Oaks "Borgia Codex Group" Summer Study Seminar, I came to the realisation that Grolier page 11 must actually be a fragment of page 10. In principle, page 11 could have been from any of the other 10 missing pages. However, from a detailed look at its contents, it is clear that the macabre figure of page 11, like the personage on page 5, must be holding up an atlatl as indicated by the dart that he has already launched toward the body of water below.

Measurements of the pages were made and the pieces were shifted horizontally with the vertical displacement fixed by a red baseline beneath the feet of the standing figures on pages 9 and 11. A preliminary, tentative reconstruction is offered in Figure 3, which shows Grolier page 9 joined to a hypothetical atlatl-wielding macabre figure on the reconstructed Grolier page 10/11. This reconstruction is further corroborated by the water-staining pattern on page 11. Though this is not clearly visible in the black and white version in Figure 3, the colour facsimile shows an approximate

match of the unstained area below the chin of the death figure with the underlying fibre remnant of page 10 from which page 11 must have been torn. It will be most important to examine the codex firsthand to verify or refute this hypothetical reconstruction.

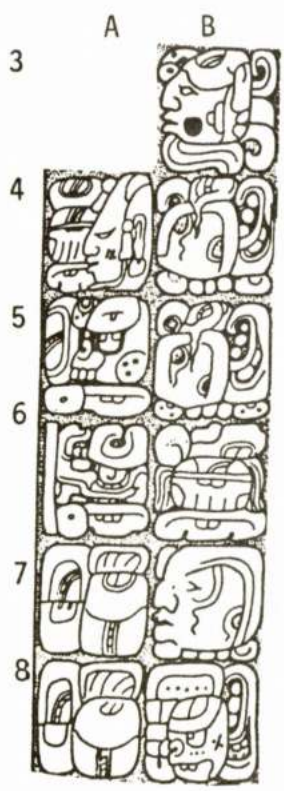
If indeed the original Grolier page 10 contained a skeletal figure, it falls naturally into a pattern with the other macabre figures on pages 2 and 6. They correspond to deities who would preside over the first appearance in the west of Venus as Evening Star following invisibility at Superior Conjunction, and who would likely retain their influence over the Evening Star period.

It had been one of the Thompson's (1975) arguments that the Mesoamericans really were only interested in Venus at heliacal rise as Morning Star. He used the fact that the Dresden table illustrates only this Morning Star event to argue that the other stations were much less important. He implied that the alleged modern fabricator of the Grolier had not grasped that the Maya would never have been interested in these other Venus stations, even though the Maya listed them all with their associated deities in the Dresden tables. Thompson further chose to ignore that even in the Dresden almanac, the same Venus glyph is used for all of the stations with nothing to single out the Morning Star manifestations as special.

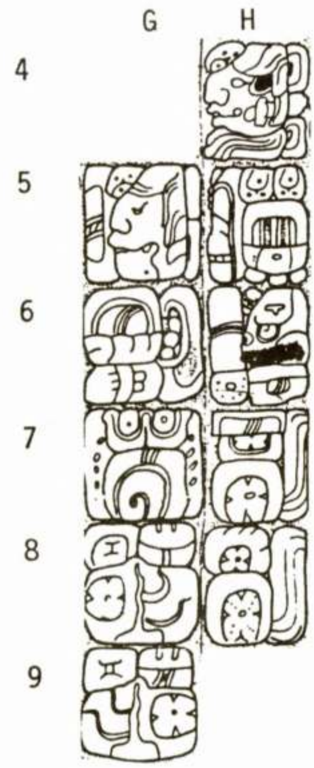
Beginning with events depicted in the famous Bonampak murals and chronicled in the texts painted on the walls, Lounsbury (1982) has been able to build a most convincing case that the Classic Maya were interested in astrologically timing raids or battle events to significant stations in the Venus cycle, be they calculated or observed. The glyphs for the events in question are the so-called "star-over-earth", "star-over-shell", and "star-over-emblem-glyph -main-sign" glyphs. These glyphs have for some time been associated with raids and warfare. David Kelley (1973, 1977) had also begun to explore the possibility that these "star" events were associated with manifestations of Venus. Using Thompson's original 584,285 Maya-Christian calendar correlation, Lounsbury (1982) has been able to show that many of the "star" events are associated with Venus. Significantly, the most numerous category of event is the appearance of Evening Star, for which Lounsbury cites eight examples.

I had heard Lounsbury's presentation of these results at the September 1981 Oxford Archaeoastronomy Symposium but had never seen a draft of the paper until July 21, 1982 when I visited him at Yale to discuss, among other things, the Grolier Codex. The preprint of the paper was a revelation because Lounsbury had discovered another Venus event glyph, a "toothy skull with distinctive markings" (see Figure 4). This toothy skull glyph is also used as an iconographic element in examples such as the headdresses worn by figures on Stela 16 and on Temple IV Lintel 3 at Tikal (also shown in Figure 4). In either glyphic or iconographic context, the association is with a Venus event, and with the Evening Star in particular.

This exciting discovery provides new insight into Maya astrology; specifically, it connects the various Venus events and



History of Katun 11
Clause B



History of Katun 12
Clause B

Figure 4(a) -- Two clauses from the historical texts from the middle panel of the Palenque Temple of the Inscriptions tablets (from Schele 1980). In the first example (Clause B of the History of Katun 11) the "toothy skull" Venus glyph is found at position A5 and is associated with an appearance of Evening Star. In the second example (Clause B of the History of Katun 12), the Venus skull glyph is found at position H6. The "star-over-shell" event glyph is at position G7. The date of this passage marks the maximum eastern elongation of Venus as Evening Star, the time when it reverses its apparent motion relative to the sun.

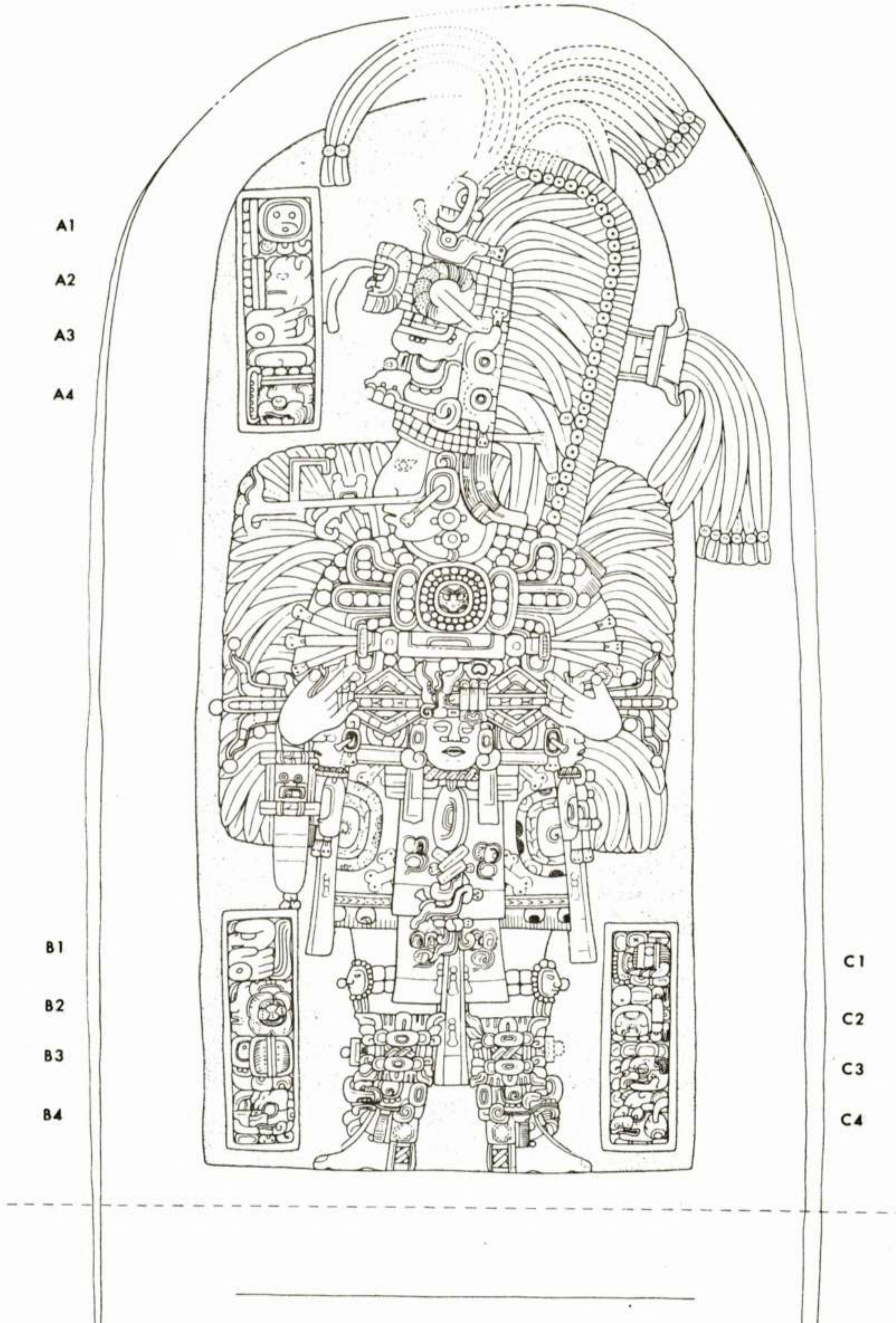


Figure 4(b) Drawing of Tikal Stela 16 by W.R. Coe (from Jones 1977: 38). The "toothy skull" Venus serves as the headdress of Ruler A, and the "star" Venus symbol may be seen at the back of the skull. The date, 9.14.0.0.0 6 Ahau 13 Muan, coincides with the first appearance of the Evening Star.

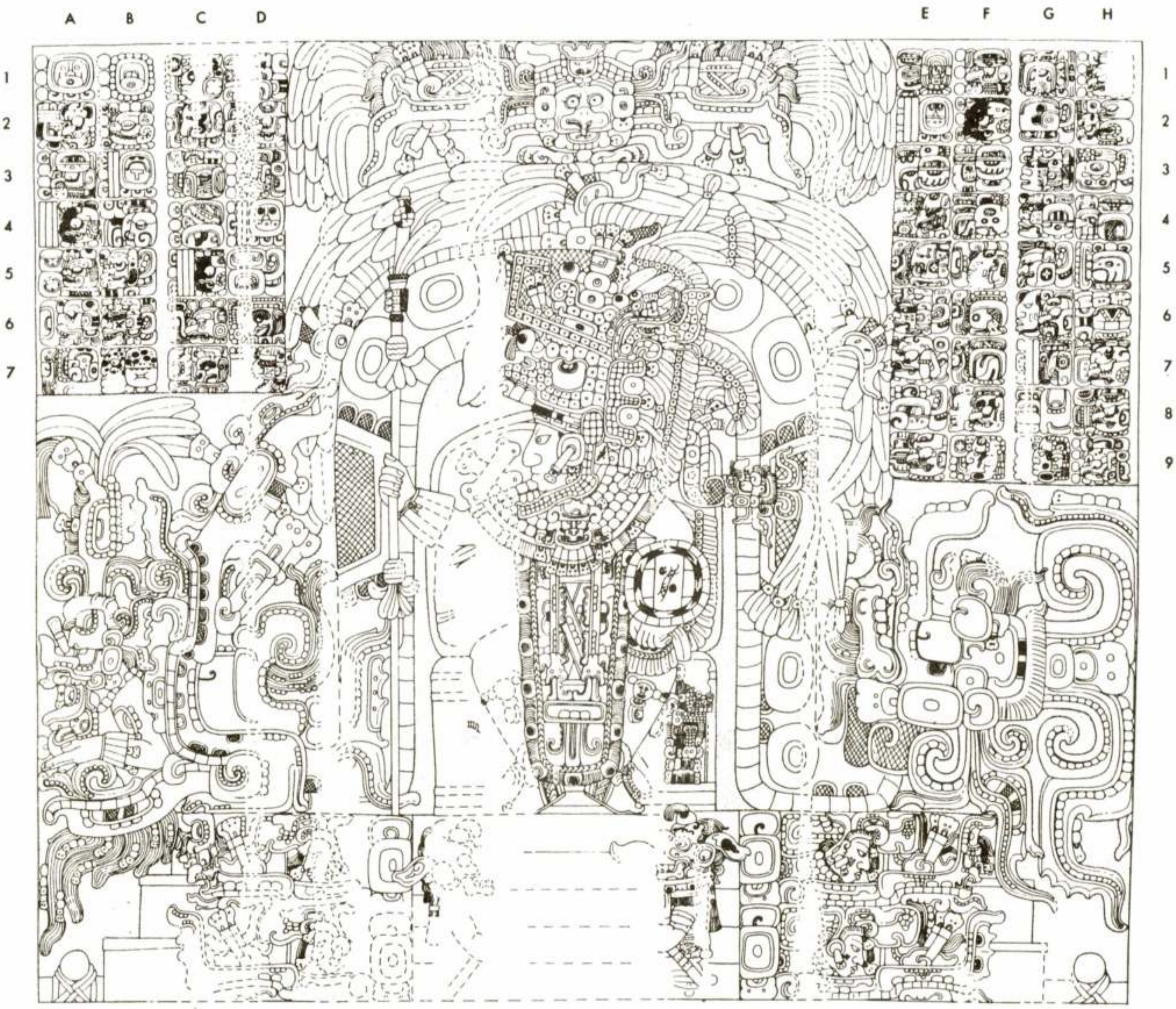


Figure 4 (c) Drawing of Tikal Lintel 3 from Temple IV by W.R. Coe (from Jones 1977: 46). The "toothy skull" with the "star" Venus symbol at the back forms part of the headdress of the standing figure. In the glyphic text to the left, a "star-over-shell" Venus event is indicated at position B4a. This event occurred on the date (9.15.12.2.2) 11 Ik 15 Chen indicated at position B3, A4. Lounsbury (1982: 157) notes that on this day, July 28 A.D. 743, "Venus as Morning Star was in precise conjunction with Mercury."

Figure 5 A pen-and-ink drawing from Seler (1961: 70) of the Venus god Tlahuizcalpantecuhtli; from Trecena IX of Codex Telleriano-Remensis (1899).

military ventures. It also directly correlates the death-head Venus glyph with the sequence of three macabre figures on Grolier pages 2, 6, and 10/11 which correspond to the first appearance of Evening Star. No hypothetical faker in the 1960s, no matter how clever, could possibly have known to put such skeletal figures on those specific pages.

One further piece of confirming evidence comes from the post-conquest Codex Telleriano-Remensis (1899) from Central Mexico. The main figure depicted on the page describing the ninth "Trecena" (the ninth of a series of 13-day divisions of the 260-day Almanac), is Tlahuizcalpantecuhtli, the god of the Morning Star (see Figure 5). This rendition of the "Lord of the House of Dawn" portrays the god with his characteristic face-painting, headdress, and striped body. A unique feature however is the toothy skull with flint blade protruding from the nasal cavity seen attached to the back of the head -- a death head wearing the headdress of Tlahuizcalpantecuhtli. A clue to the meaning of this unusual portrayal is given by the Spanish gloss below the picture:

Este tlauiz calpantecutli quiere dezir la mañana quando ameceçe y lo mesmo es señor de aquella claridad quando quiere anocheçer. Este es señor destros treze dias, ayunavan los quatro prosteros. (Codex Telleriano-Remensis 1988:26).

Translated, this passage may be rendered:

This Tlahuizcalpantecuhtli means lord of the morning when it dawns and equally he is lord of that bright star when evening comes. He is the lord of these 13 days, they fasted during the last four.

I interpret this gloss as a statement that, at least in Central Mexico around the time of the conquest, Tlahuizcalpantecuhtli was Lord both of the Morning Star and of the Evening Star. Furthermore, it seems that the artist of the Codex Telleriano-Remensis intended to show both of these manifestations of the Venus God with the death head clearly being the Evening Star. When we compare this figure with Evening Star sacrificer of Grolier page 6, the coincidence is particularly striking. Other skeletal forms of Tlahuizcalpantecu-htli may be seen in the Borgia and Cospi Codices (Seler 1904) as well as on the Tizatlán murals (Noguera 1927). In these cases also, I would suggest that we may be viewing the Evening Star manifestations of the deity, a macabre Venus character that we now know the Maya associated with astrologically-timed raiding events to obtain captives. These Central Mexican examples further strengthen the case both for the pan-Mesoamerican nature of this Venus tradition and for the genuineness of the Grolier Codex.

Conclusion

The Grolier Codex, despite the unfortunate circumstances of its discovery, provides a most important contribution to our understanding of the Post-Classic Mesoamerican world. Not only does it give us a new look at the process of cultural amalgamation taking place in the Maya area at that time, but it also corroborates

and contributes to the new evidence for the importance of the Mesoamericans of Venus events other than the heliacal rise of the Morning Star.

Because of the lingering questions about the authenticity of the Grolier Codex, very little if any research has been done since it was first publicly displayed in the early 1970s. Furthermore, the manuscript has apparently been returned to Mexico where it has been essentially unavailable for general study. Though technically the Codex is owned by Josué Saénz, I understand that it is now kept in the "bodega" of the National Anthropological Museum in Mexico City. A careful re-examination should now be made in the light of the new evidence presented in this paper.

Radiocarbon dates should be obtained, using the recently developed small sample technique, for fibers of the bark paper from one of the actual codex pages. The paint and stucco must be analysed chemically for any traces of modern inks or pigments. The patterns of water staining should be examined to see how the sections of the codex may have fitted together when found. In this context, I believe that the evidence suggests that the codex may have been damaged or tampered with at some time in antiquity after its placement in the cache -- long before its modern discovery. It may be possible to tell if the ten missing pages of the almanac were attached to the present manuscript when found by the huaqueros.

Finally, it should be possible to verify the hypothesis that Grolier page 11 is actually the lower portion of page 10. It is clear from the published facsimile (Coe 1973) that the lower portion of page 10 had been ripped off leaving plies of the underlying fibrous paper. Since the page 11 fragment would have overlapped a portion of this area, it should be possible to compare the water staining and fiber patterns to ascertain the precise relationship of the two pieces. Furthermore, the published facsimile seems to be in error in attaching a piece of red-painted border to the right edge of page 11. This must certainly be incorrect and an inspection of the original should verify this.

In the Handbook of Middle American Indians, John Glass (1975:12) lists the only sixteen known preconquest pictorial manuscripts of Mesoamerica -- and two of these may actually date from the early colonial period. The Grolier Codex, as a genuine hybrid-style thirteenth-century Maya Venus almanac, adds substantially to the corpus of pre-Columbian books as the future seventeenth entry in Glass' census. It is the fourth Maya codex, the only one currently residing in Mexico. As such, we hope that this important Mexican national treasure will soon be acknowledged and made available for scholarly research.

Page (Grolier)									1	2	3	4	5	6	7	8	9	10		
Column	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Position*	SC	ES	IC	MS	SC	ES	IC	MS	SC	ES	IC	MS	SC	ES	IC	MS	SC	ES	IC	MS
Ring number									90	250	8	236	90	250	8	236	90	250		
Day sign	Cib	Cimi	Cib	Kan	Ahau	Oc	Ahau	Lamat	Kan	Ix	Kan	Eb	Lamat	Etz'nab	Lamat	Cib	Eb	Ik	Eb	Ahau
	3	2	5	13	2	1	4	12	1	13	3	11	13	12	2	10	12	11	1	9
	11	10	13	8	10	9	12	7	9	8	11	6	8	7	10	5	7	6	9	4
	6	5	8	3	5	4	7	2	4	3	6	1	3	2	5	13	2	1	4	12
	1	13	3	11	13	12	2	10	12	11	1	9	11	10	13	8	10	9	12	7
	9	8	11	6	8	7	10	5	7	6	9	4	6	5	8	3	5	4	7	2
	4	3	6	1	3	2	5	13	2	1	4	12	1	13	3	11	13	12	2	10
	12	11	1	9	11	10	13	8	10	9	12	7	9	8	11	6	8	7	10	5
	7	6	9	4	6	5	8	3	5	4	7	2	4	3	6	1	3	2	5	13
	2	1	4	12	1	13	3	11	13	12	2	10	12	11	1	9	11	10	13	8
	10	9	12	7	9	8	11	6	8	7	10	5	7	6	9	4	6	5	8	3
	5	4	7	2	4	3	6	1	3	2	5	13	2	1	4	12	1	13	3	11
	13	12	2	10	12	11	1	9	11	10	13	8	10	9	12	7	9	8	11	6
	8	7	10	5	7	6	9	4	6	5	8	3	5	4	7	2	4	3	6	1

*SC, Superior Conjunction.
ES, Evening Star.
IC, Inferior Conjunction.
MS, Morning Star.

Table 1 The Scheme of the Maya Venus Cycle from the Dresden Codex with the surviving portion of the same almanac in the Grolier Codex enclosed (from Coe 1973: 160, Table 3).

Table 2 The "Scheme of the Venus Cycle" on the left halves of Dresden Codex pp. 46-50, restored and corrected by Thompson (1972: 66).

SCHEME OF THE VENUS CYCLE ON DRESDEN 46–50 (restored and corrected)

	Page 46				*Page 47*				*Page 48*				*Page 49*				*Page 50*			
Line	Cib	Cimi	Cib	Kan	Ahau	Oc	Ahau	Lamat	Kan	Ix	Kan	Eb	Lamat	Etz'nab	Lamat	Cib	Eb	Ik	Eb	Ahau
1	3	2	5	13	2	1	4	12	1	13	3	11	13	12	2	10	12	11	1	9
2	11	10	13	8	10	9	12	7	9	8	11	6	8	7	10	5	7	6	9	4
3	6	5	8	3	5	4	7	2	4	3	6	1	3	2	5	13	2	1	4	12
4	1	13	3	11	13	12	2	10	12	11	1	9	11	10	13	8	10	9	12	7
5	9	8	11	6	8	7	10	5	7	6	9	4	6	5	8	3	5	4	7	2
6	4	3	6	1	3	2	5	13	2	1	4	12	1	13	3	11	13	12	2	10
7	12	11	1	9	11	10	13	8	10	9	12	7	9	8	11	6	8	7	10	5
8	7	6	9	4	6	5	8	3	5	4	7	2	4	3	6	1	3	2	5	13
9	2	1	4	12	1	13	3	11	13	12	2	10	12	11	1	9	11	10	13	8
10	10	9	12	7	9	8	11	6	8	7	10	5	7	6	9	4	6	5	8	3
11	5	4	7	2	4	3	6	1	3	2	5	13	2	1	4	12	1	13	3	11
12	13	12	2	10	12	11	1	9	11	10	13	8	10	9	12	7	9	8	11	6
13	8	7	10	5	7	6	9	4	6	5	8	3	5	4	7	2	4	3	6	1
14	4	14	19	7	3	8	18	6	17	7	12	0	11	1	6	14	10	0	5	13
	Yaxkin	Zac	Zec	Xul	Cumku	Zotz'	Pax	Kayab	Yax	Muan	Ch'en	Yax	Zip	Mol	Uo	Uo	Kankin	Uayeb	Mac	Mac
16	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.
17	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
18	Red ½	Red ½	Red ½	Red ½	Red	Red	Red	½	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus
19	236	326	576	584	820	910	1160	1168	1404	1494	1744	1752	1988	2078	2328	2336	2572	2662	2912	2920
20	9	19	4	12	3	13	18	6	2	7	17	5	16	6	11	19	15	0	10	18
	Zac	Muan	Yax	Yax	Zotz'	Mol	Uo	Zip	Muan	Pop	Mac	Kankin	Yaxkin	Ceh	Xul	Xul	Cumku	Zec	Kayab	Kayab
21	T	A	B	C	D	E	F	G	Winged	Winged	Winged	Winged	Winged	Winged	Winged	Winged		Winged	Winged	Winged
									Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen	Chuen
22	Winged	Winged	Winged	Winged	..	..	..	..	H	I	. J	K	L	M	N	O	P	Q	R	S
	Chuen	Chuen	Chuen	Chuen																
23	Red	Red	Red	Red	Red	Red	Red	Red	..	..	..	..	Red	Red	Red	Red	Red	Red	Red	Red
	Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus					Venus	Venus	Venus	Venus	Venus	Venus	Venus	Venus
24	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.	E.	N.	W.	S.
25	19	4	14	2	13	3	8	16	7	17	2	10	6	16	1	9	0	10	15	3
	Kayab	Zotz'	Pax	Kayab	Yax	Muan	Ch'en	Ch'en	Zip	Yaxkin	Uo	Uo	Kankin	Cumku	Mac	Mac	Yaxkin	Zac	Zec	Xul
26	236	90	250	8	236	90	250	8	236	90	250	8	236	90	250	8	236	90	250	8

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Quichean Time Philosophy

Beginning with the important work of Heinrich Berlin (1958) and Tatiana Proskouriakoff (1960), there has been a revolution in our thinking about the supposed Mayan glorification of or obsession with time. Previously it had been assumed that all Mayan hieroglyphic texts dealt solely with recurrent cyclical astronomical matters (Thompson 1954). Then, with the sudden breakthrough in hieroglyphic textual analysis it became clear that many of the texts on Classic Maya stelae recorded births, dynastic successions, alliances, marriages and deaths of individuals. Nonetheless, not all Mayan texts, even on stone monuments, concern such historical matters. Thus far, the extant Precolumbian codices (Madrid, Paris, Dresden and Grolier) are believed to contain primarily cyclical, ritual and astronomical matters. We have a difficult theoretical problem here because in Western thought, beginning with the Classical Greeks, temporal modes are described as either cyclical and recurrent <u>or</u> as linear and non-repetitive. This dichotomy ultimately rests on the contradiction between Plato's view of time as the measure of the motion of a body and Aristotle's view of time as the motion of bodies. Since Classic Mayan cyclical and lineal time models are clearly present archeologically in the same sites at the same time horizon, it would appear that the Mayas had somehow resolved this apparent contradiction, if indeed they even took these models to be in conflict or contradiction. Our problem, then, is to examine this supposed contradiction in order to construct a new model of Mayan time philosophy.

As a first step, let me assume that the Maya may have had different times for separate provinces of their reality--biological, astronomical, mechanical, psychological, historical, religious, social-- and that these various time perspectives underwent a process of "totalisation" (as Sartre would call it) recorded and rationalized within the intermeshing cycles of their calendars. I come to this intuition from the study of modern Mayan multimetrical temporal concepts and rituals involving dialectical thought patterns which go far beyond the dialectics of polarization (thesis, antithesis, synthesis), as historically exemplified in Hegelian and Marxist circles, to include the dialectics of complementarity, overlapping or mutual involvement, and reciprocity.[1] These insights concerning the dialectics of Mayan temporal concepts come from reflections upon data gathered during twenty months of anthropological fieldwork, including a formal apprenticeship to a calendar priest in Momostenango, Guatemala.[2]

The community of Momostenango is located in the Midwestern Highlands of Guatemala at 15.04° north of the Equator. Although

this community is located in the tropics, the climate is quite temperate because it lies from one to three thousand meters above sea level. The population of this municipality is approximately 45,000 persons, of whom the overwhelming majority (98%) are Quiché-speakers. Momostenango is perhaps best known to travelers for its fine woolen blankets and to ethnographers for its celebration of 8 Batz', the largest ongoing calendrical ritual anywhere in Mesoamerica today that is scheduled according to the 260-day (rajilabal k'ij[3] "counting of suns and days") sacred almanac. Here reside nearly 10,000 initiated female and male "burners" (poronel) and "daykeepers" (ajk'ij), who are formally trained and initiated in calendrical rituals (in accordance with both the solar 365-day cycle and the sacred 260-day cycle) by a formal three-tiered hierarchy of male priest-shamans known as "mother-fathers" (chuchkajawib).

Unlike many other Guatemalan communities, where calendar experts have been persecuted and peripheralized by Roman Catholic priests and indigenous lay catequistas, the Momostecan hierarchy of calendar experts has prevented such religious domination by carefully controlling access to the coveted positions of eldership within the community. As elsewhere in Mesoamerica, one may speak of a "civil-religious hierarchy" in Momostenango, but here the bridge between religious and governmental duties is provided by this group of calendricists rather than by the leaders of the local Catholic confraternities. Thus, men who are actively working toward the respected position of elder within the community tend to avoid serious involvement in the confraternities and instead undergo further training in calendrical ritual, so as to ascend in the local hierarchy.

The first level of religious training is that of a simple "burner", a man or woman who may approach the outdoor community altars in order to burn incense and make offerings to the ancestors and deities. Novices undergoing training for this office are known as "burdens" (ëkomal) during the 65-day period known as "washing for the work service" (ch'ajbal chac patan), which begins shortly after noon on 1 Cawuk. On this date the teacher arrives at Paja', "In the Water," a shrine which is located in a barranca on the edge of a stream just west of the town center. There the teacher begins the "back part of the path" (rij ubinibal, literally "rear or back of the instrument-for-walking or traveling"), which is the current expression in Quiché for indicating the beginning of a set of calendrical rituals. This spatio-temporal concept places the speaker in the position of starting off behind the final or "big" day of the initiation rather than as standing before, as we express it in phrases such as "the night before Christmas".

Beginning the 65-day ritual series slightly after high noon, when the sun is directly overhead, raises a question as to when the Quiché begin and end their days. This issue has been much debated in the literature on other Mayan groups, with noon and sunset being the favourite candidates for the boundary line between two successive days (La Farge 1930: 657; Redfield and Villa Rojas 1934: 184; Lincoln 1942: 110; Villa Rojas 1945: 143-44; Thompson 1950: 102). At first glance the case of the 1 Cawuk would seem to

support the noon theory, and so would the way in which the Momostecans sometimes take notice of the fact that the bells of the parish church are striking twelve. Having stopped what they are doing long enough to glance up at the sun, they may then say a brief prayer with their faces still uplifted slightly, addressing the sun by invoking the day-- for example, Sa'j la Ajaw Wajxakib K'anil, "Come here, Lord 8 K'anil." But then, if several people happen to be together at this time, they will greet one another (as if they had just met) by using the expression that is appropriate for the rest of the afternoon: xbe k'ij, "the sun (day) went," in which x- indicates completed action-- the implication being that the sun has just already done something, rather than that something has just begun. This is quite a disorientating experience to the outsider, especially if that outsider already knows that high noon is ordinarily referred to conversationally in Quiché as nic'aj k'ij "middle of the sun (or day or time)." How can the "middle of the day" also be the time when the day is greeted and asked to enter or come here, and simultaneously be the time when the day "went"? In what sense is noon the beginning, middle, and end of the day, sun, and time? This case is partly resolved when one learns that the path of the sun is referred to in Quiché as oxib uxucut "three corners," consisting of sunrise (relebal k'ij, "the coming-out place of the sun"), noon (nic'aj k'ij, "middle of the sun, day or time"), and sunset (ukajibal k'ij, "the going-down place of the sun"). These three "corners" are considered the three main turning points or transitions in time, in which the influences of day (k'ij) and night (ak'äb) overlap in a dialectics of mutual involvement.

At the 15° latitude where Momostenango is located, night comes on rapidly at sunset, which occurs around 6 p.m., with only very slight seasonal fluctuations. At this time in the evening one greets people on the path in Momostenango with xoc ak'äb "night entered." Night continues on into early dawn. At this time there are black streaks low on the eastern horizon, with a yellow background that slowly intensifies and deepens into orangeness (ya' k'ak' chuwi xe kaj, literally "fire is given there at the bottom edge of the sky"). Then all of the colour slowly disappears and the rising of the sun itself brings about a process called sakir uwäch ulew ("the face of the earth whitens or lightens"). If one meets a person on the path at this time the proper greeting is sakiric "it is getting white or light," and this continues to be the proper greeting until noon. However, even though the sun has now appeared, this time of day is known as nimak'äb "big night," which indicates that the night has grown very large or long and is nearing its end. This seems strange until one realizes that the period of time between dawn and noon is considered an especially delicate, cool time when the sun is slowly climbing up the sky. Then when it reaches noon it is quite strong for a time, but it is already spoken of as if it had completed itself.

In the attempt to decide beginning and ending points for a day, one encounters the same sort of problems I have discussed elsewhere in connection with the misdirected search for a beginning or ending point for the 260-day cycle (Tedlock 1982: 93-97). Just as I discovered that Momostecans were more interested in offering a

particular day as the middle of the cycle rather than in speculating on the question of its "beginning," so I must suggest here that the important issue at the scale of a single day is the midpoint. At noon, the day is maximally 8 K'anil (or whatever the Day Lord is), and the influence of 8 K'anil rises before that moment and declines after it. A dream occurring on the previous night, at whatever hour of the darkness, will be spoken of as having been handed from 7 Can to 8 K'anil; a dream of the following night is handed over from 8 K'anil to 9 Toj, and so forth. From the fact that a day has a sharply marked middle it does not follow that-- at least not in Quichean dialectics-- that is has sharply marked beginning and ending points. The moments of sunrise and sunset are certainly used to mark time, but they do not provide absolute boundaries for the influence of successive Day Lords. As for "midnight," that is a moment that is reckoned in accordance with events that belong to the night itself rather than a boundary between two "days," as we shall see later on.

Now, returning to the rites performed on the afternoon of 1 Cawuk, we can see more clearly why this time of day is chosen. Once noon has past, the influence of 1 Cawuk is strong but is already declining, pointing forward, as it were, to the rest of the series of rituals which it begins. Starting with the second day in the series (1 E) and from then on, a teacher may well prefer the early morning hours, before the capacity of a Day Lord to listen to prayers has been worn out. He returns on 1 E to the same shrine he visited the first time (Paja', In the Water), where he again asks permission of the Day Lord-- and of his own direct ancestors-- to train the novice. After this second ritual he begins to give intensive instruction in time reckoning, cosmology, observation of the sun (ki'j), moon (ic'), and stars (ch'umil), herbal and shamanic curing and proper ritual behaviour to be followed at the outdoor shrines. Now, the rhythm of his visits to the shrines speeds up to 7- and 6-day intervals in order to intercalate or insert the 8-day series (wajxakibal) into the 1-day series (junabal) that was started first. With the first 8-day, 8 Cawuk, there is also a shift of locale to Ch'uti Sabal, "Little Declaration Place," which is a shrine located on a hilltop half a kilometer due west of Paja'. Six days later on 1 Can the teacher returns to the low shrine at Paja'.

This series of 1-days and 8-days (see fig. 1) rotates back and forth at 7- and 6-day intervals to produce the following meter: 1 Cawuk + 13 = 1 E + 7 = 8 Cawuk + 6 days = 1 Can + 7 days = 8 E + 6 days = 1 Batz' + 7 days = 8 Tijax + 6 = 1 C'at. Expressed in the language of Western music, this 65-day "back of the path" time period opens with a 13/65 time signature, in which the right-hand figure (65) indicates the unit of measurement (1/65 of the total time period under consideration), and the left-hand figure (13) indicates the number of such units in each measure. In this ritual series, however, after only one measure the meter speeds up and alternates back and forth four times from 7/65 to 6/65 through eight measures, producing an irregular multimeter. This multimeter resolves itself and achieves an exciting asymmetrical balance through the principle of dialectical complementarity, in which the distinctions (7 and 6) are simultaneously in an alternating

relationship to each other-- 7, 6, 7, 6, 7, 6, 7, 6-- and in dialectical completion of each other-- the original 13 is matched with 7 + 6 = 13, repeated four times. A third type of dialectical complementarity, known as direct opposition, is present in the spatial dimension of the rituals, in the shift from low to high place (Paja'/Ch'uti Sabal); low to high number (1/8); east to west; and wet to dry.

After a person has been initiated as a "burner," she or he may decide to go on to be a "daykeeper," by completing another 65-day "back of the path" permission period known as "washing for the mixing pointing" (ch'ajbal baraj punto). This period begins at the Paja' shrine with 1 Quej (see fig. 1), which is then followed 13 days later by 1 Junajpu, also at Paja'. At this point the cycle begins the alternating 7- and 6-day multimeter pattern: 1 Quej + 13 = 1 Junajpu + 7 = 8 Quej + 6 = 1 Aj + 7 = 8 Junajpu + 6 = 1 Came + 7 = 8 Aj + 6 = 1 Cawuk + 7 = 8 Came + 6 = 1E. The first thing to notice about these two 65-day time periods is that the second one, for the more advanced initiation as an ajk'ij "daykeeper," actually falls earlier within the 260-day cycle than the first 65-day period for the training as a "burner" (see fig. 1). Secondly, these two 65-day time periods are overlapping, so that the first and second days of the "washing for the work service" are also, respectively, the third-to-last and final days of the "washing for mixing and pointing." Thus, the teacher completes the chronologically later 65-day period (work service) first and then waits nearly 250 days to begin the earlier (mixing and pointing) 65-day period.

The initiation as either a "burner" or a "daykeeper" is celebrated in a two-step procedure which takes place outside of the 65-day (rij ubinal "back part of the path") ritual series. In the case of a "burner" these rituals are performed on 7 Tz'i' and 8 Batz', while in the case of a "daykeeper" the days are 8 Batz' and 9 E. The rituals on 7 Tz'i' take place at either the home of the novice or of the teacher beginning at sunset (ukajibal k'ij, "the going down of the sun," which is simultaneously the term for the western direction), culminating with fireworks late in the evening. Then, on 8 Batz', the rituals take place at the 8-day shrine, Ch'uti Sabal, beginning very early in the day, after Venus as morning star (junajpu) has risen, or if Venus happens to be an eveing star (rask'äb) or simply is not visible at all, when the earliest rays of light have appeared among the black clouds at the horizon (xe kaj "end of the sky"). If the person initiated will become a burner, then this is the final day of his/her initiation. Later, if the person is being initiated as a daykeeper, s/he will celebrate 8 Batz' once more and then go, on the next day (9 E), to a higher shrine known as Nima Sabal, "Large Declaration Place." The first day of these two sets of initiatory days (7 Tz'i' and 8 Batz', respectively) is known as the "broom" (mesebal), while the second day (8 Batz' and 9 E, respectively) is known as the "big day" (nima k'ij).

The ideal pattern in Momostenango is to speed up the initiatory process by completing these two overlapping 65-day cycles during just one 260-day period, so that the novice is simultaneously initiated as both a burner and a daykeeper (see fig. 1). In order

to "double-time" these two initiations the "permissions" must begin with the second, or more advanced "mixing and pointing" series and then, before the completion of this cycle, the first day (1 Cawuk) of the first set of "work service" must be intercalated. This means that the next day (8 Came) of the "mixing and pointing" set must be picked up after the first day (1 Cawuk) of the "work service" set has occurred. This is followed by 1 E, which occurs as the last day in the "mixing and pointing" and the second day in "work service." The double-time series then continues straight on with the remainder of the days of the work service series. Initiation in this double-timed system is celebrated during the three-day consecutive period of 7 Tz'i', 8 Batz' and 9 E. When the two levels of initiation are combined (through a dialectics of mutual involvement) within a single 260-day cycle, 7 Tz'i' is known as the "broom" (mesebal), 8 Batz' is the "eve" (mixprix) and 9 E is the "big day" (nima k'ij).

The pattern whereby rites of passage are marked by three consecutive days of ritual activities at the end of a double-timed cycle is replicated on the higher levels of the religious hierarchy of Momostenango, ranging upward through the mother-fathers of the patrilineages, the cantons and the town as a whole. Thus, for example, in the case of either of the two mother-fathers of the town, the "back part of the days" before the initiation into this office can theoretically be done in two separate time periods. The first one, the "backpack" or ĕka'bal (literally "pack frame" or "yoke"), stretching from 1 Quej to 1 Toj (see fig. 2), is divided into 65 + 65 + 52 days = 182 days (or one half of the solar year). This involves the burning of great piles of copal incense, praying and making of other offerings for the benefit of Momostenango, and even for the entire world. The second is the "washing of the shrine" or ch'ajbal rech awas (literally "washing of the taboo"), which stretches from 1 Toj to 1 Batz' and is likewise divided into 65 + 65 + 52 = 182 days. The two parts can be done in two separate solar years, but in 1976 when the new mother-father for Pueblo Viejo was initiated they were double-timed. The "back part of the days" began with the "later" series, the "washing of the shrine," and ran as follows: 1 Toj + 13 = 1 Ik' + 7 = 8 Toj + 6 = 1 Tz'iquin + 7 = 8 Ik' + 6 = 1 K'anil + 7 = 8 Tz'iquin + 6 = 1 Imöx + 7 = 8 K'anil + 6 = 1 Ix = 65 days. What would have been the "earlier" series, the "backpack," began 13 days after 1 Ix on 1 Quej, and was thereafter intercalated with the "washing of the shrine" series. The combined backpack and washing rituals of 1 Quej were followed by a return, 7 days later, to the washing rituals on 8 Ix, a day which is skipped in the backpack series when it is done alone. With the exception of 8 Ix, the two sets of rituals were done together from 1 Quej until 1 Batz', combining the washing of the town shrines (i.e. removal of previously burned copal) and the backpacking of the town. Next the backpacking continued on alone, but only until 1 C'at. Thus, in actual practice what could have been 2 x (65 + 65 + 52 = 182) = 364 days were overlapped (through the dialectics of mutual involvement) and reduced to 65 + 13 + 65 + 52 = 195.

As in the case of the combined burner and daykeeper initiation discussed earlier, the initiation of mother-fathers of the town

took place on three consecutive days. The first or "broom" day was 9 E, the second or "eve" was 10 Aj and the third or "big" day was 11 Ix. If the backpack and washing series had been done over two separate years, they would have each been culminated by a two-day ritual. I could detail many more examples of contrasting two-day and three-day rituals, but the general rule is this: wherever such rituals are the culmination of two overlapping counts of days, the observances will span three days. Otherwise, they will span only two.

Reflecting on the so-called "tzolkin triad" found in the eclipse tables of the Dresden codex (pp. 53a-58b), one wonders if this might also have marked off overlapped cycles. Various hypotheses concerning the possible function of this triad have been advanced. For example, Satterthwaite (1965: 623) thought that it might have been used as +/- 1-day allowance (e.g. a three-day error range) in lunar correction or variation. An alternative interpretation is that it was used to shift from one line to the next above it at certain periodic intervals (Andrews 1940: 156; Lounsbury 1978: 796). Most recently, it has been suggested that it functioned as a one-day recession of the window-defining base dates necessitated by the recycling of the table (Bricker and Bricker 1983: 12). Alternatively, I would suggest that the triads in this table indicate that double or even multiple cycles are overlapped, quite aside from the question of variability or recession in the astronomical phenomena that may correlate with these cycles. The Brickers focus on the solar aspect of this table, but following my sense of the Mayan (or at least Quichean) preference for overlapping dialectics and for multimetrical time reckoning, I follow Kelley in calling these table "lunar-solar" (1976: 42-43). The ethnographic research needed to pursue these issues further has barely begun (see Remington 1977; Neuenswander 1981). What is specifically needed is more information on contemporary highland Guatemalan conceptualization and observation of the moon, and of the nocturnal sky in general. The richness of what remains to be learned is only hinted at in what I will be able to sketch out here.

There is a general and widespread interest in the night sky in Momostenango. This is particularly true during the cold, dry season months of November, December, January and February, when people rise after midnight and go visiting, consult diviners and attend seances. At this season of the year, on nights without a bright moon, the winter Milky Way or ube tew, "ice road," clearly reveals its rift; that part of the Milky Way is called xibalba be, "road to the underworld." Night rituals which take place during this season are marked in terms of the rising of certain stars and constellations. These time markers include the rise of Regulus (jun ch'umil, "one star"), Orion's Belt (oxib ch'umil, "three stars") and the Big Dipper (pac', "cupped hands"). During this same season, on the night of the full moon (rija ic'), when the Milky Way is barely visible, people rise when the moon is at its peak near midnight and walk to the various hot mineral springs in the community in order to bathe. These trips to the springs involve courtship and sexual liaisons, which are timed in accordance with the phases of the moon.

When the moon is "small" (alaj) it is a time when all of the world is considered tender-- animals, plants, trees and people. During the fifteen days (7 + 8) of the waxing moon, butchering, harvesting, woodcutting and sexual relations are avoided. Then, on the night of the full moon and for the following fifteen days until the dark of the moon, when she is "buried" (mukulic), all of these activities become propitious, since the moon, and all humanity with her, are now hard or mature (rij). These idealized fifteen-day intervals recall the similar intervals that appear seven times in the lunar-solar table of the Dresden codex.

The night of the full moon (jun ak'ab ube "one night her road") is a particularly important night each month in Momostenango. Only on this night does the moon's path-- called (like the sun's path oxib uxucut, "three corners"-- cross the sky from east to west in a single night. The three corners consist of moonrise in the east (relebal ic', "the coming-out place of the moon"), midnight of the full moon (pa nic'aj "at the halfway" or "middle") and moonset in the west (ukajibal ic' "the going-down place of the moon"). In order to contrast them, the solar and lunar triangles are referred to respectively as chupam sakil "in the light" and chupam k'ekum "in the darkness." It was not until I understood these triangles that I could understand a remark that a Momostecan layman once made while we were walking down a path just after sunset. On seeing the full moon that had just come up, he said: "The sun has risen." Here I would suggest that at least some of the kin or sun glyphs in the Dresden lunar-solar tables (see 56a, 52b, 54b, 56b, 57b and 58b), superimposed on boundaries between light and dark backgrounds, might be metaphors for the full moon rather than literal indications of the sun.

In the more esoteric world of priest-shamans, there is an even greater and more serious interest in the paths of the heavenly bodies. Those who have been initiated as mother-fathers at any level of the three-tiered hierarchy visit the highest hills within the community on regular schedules, and the two who are at the highest level visit the sacred four-directional mountains as well. Some of these sacred places have good views of the sky and of large stretches of the horizon. The following information on ritual cycles was gathered without knowledge of the possible importance of 82-day cycles (3 x 27 1/3 = 82) in charting the motion of the moon among the constellations (see Aveni 1980: 67-82).

Momostecan patrilineage leaders visit Nima Sabal, one of the highest shrines, on the following sequence of days: 9 Quej + 13 = 9 Junajpu + 13 = 9 Aj + 13 = 9 Came + 13 = 9 Cawuk + 13 = 9 E + 13 = 9 Can + 4 = 13 Toj = 82 days. On the first day of this series they open their particular patrilineage's shrine at Nima Sabal at sunset and remain for some time, burning incense, praying to their dead predecessors in office by name and observing the night sky. In these prayers they mention the phases of the moon and its position in the night sky. They are particularly interested in the seasonal variations in the moon's path through the summer Milky Way (saki be, "white road"), which they compare with its passage through the bifurcated winter Milky Way. They discuss these variations among themselves and occasionally make notes on their Gregorian calendars

at home. Certain men are known as experts in predicting rain according to the phases of the moon in its seasonal voyage through the Milky Way. These men carefully observe the night sky on all seven days of this series of 9-days (belejebal), but this is not considered necessary by the others, who observe the night sky with any seriousness only on the opening day (9 Quej) and 82 days later on the closing (13 Toj), when they once again arrive at sunset to pray, burn incense and observe the night sky before they close the shrine for a 22-day period. They will repeat this pattern once again on 9 Batz' + 13 = 9 C'at + 13 = 9 No'j + 13 = 9 Tz'i' + 13 = 9 Ak'abal + 13 = 9 Ajmac + 13 = 9 Toj + 4 = 13 Ajmac, at which point another 82-day cycle has passed. Now the shrines remain closed for 74 days before the first cycle, from 9 Quej to 13 Toj, begins again. These 82-day periods are referred to in Quiche as chac'alic "to be staked, suspended, stabilized or set," which was explained to us as referring both to the firm placement of a table on four legs and to the forked poles which are planted to support the roof beams of a new house.

The point of particular astronomical interest here is that wherever the moon (if visible) might have been located among the constellations on a given 9 Quej or 9 Batz', it would be in the same position 82 days later on the following 13 Toj or 13 Ajmac, respectively. It requires further fieldwork to confirm the present evidence that this cycle is precisely what the mother-fathers are observing when they make their nocturnal visits to Nima Sabal. I should add that I also have evidence of four different 82-day periods in the rituals performed by one of the two mother-fathers who serve the entire town of Momostenango, but those rituals, which involve overlapping 82-day cycles with others of 40 and 65 days, require a separate paper to themselves.

The reckoning of 82-day periods in Momostenango, and their connection with ritual mountaintop visits that are known to include observation and discussion of the night sky, make it necessary to re-open the question as to whether Mayan astronomy included not only synodic moon-reckoning, but sidereal reckoning as well. On the synodic side, the conceptual identity of the moon with the sun, on just the one night of the full moon, may give us new ways of reading and interpreting the lunar-solar pages in the Dresden codex. And the "tzolkin triads" in those same tables may signal the overlapping of two or more cycles, as do three-day rituals at Momostenango, rather than providing for errors of measurement.

The conception of the oxib uxucut or "three corners" of the paths of the sun and the full moon may call for a re-opening of the question as to whether ancient Mayan astronomers were interested in angles, though of course the corners in question here are angles attributed to the celestial movements themselves rather than to the geometry of observation.

On the issue of Mayan time philosophy, it is apparent that contemporary Quiche thinking about time frequently follows a dialectics of overlapping or mutual involvement. There are moments of dialectal complementarity, as when time intervals both alternate (as between 7 and 6 days) and complete one another (to add up to the

meaningful pattern number of 13), or when two separate shrines (one for 1-days and the other for 8-days) are in direct and unmediated opposition in a particular ritual cycle. On the other hand, a dialectics of mutual involvement is seen when burner (or work service) rituals overlap with daykeeper rituals, when washing rituals overlap with backpacking rituals, and when night overlaps with day.

Notes

1 For excellent discussions of various forms of dialectics see Gurvitch (1964) and Sartre (1976).

2 This fieldwork was made possible by a Research Fellowship from the State University of New York at Albany and by a summer Faculty Fellowship from Tufts University. Tony Aveni, Dennis Tedlock and Mary Jane Cramer have all made useful suggestions on the first draft of this paper, which the author has incorporated. Any remaining ambiguities are her own. I am most grateful for the support provided by these individuals and institutions.

3 The orthography used for Quiché in this paper is the practical one suggested by the Instituto Indigenista Nacional de Guatemala (see David G. Fox, Lecciones elementales en Quiché, pp. 15-18). Vowels are pronounced as in Spanish, ë is like the vowel in English "met," and ö is like the vowel in English "foot." Consonants are also as in Spanish, with an equivalence between c (used before a, o and u) and qu (before e, i), except for k, which is articulated with the tongue farther back than for c or qu; tz, which is like the German Zeit; w, which is like English w; x, which is like the English sh; and b, which is a glottalized p. Other glottalizations are indicated by '.

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Fig. 1

WORK SERVICE (Burner)	MIXING POINTING (Daykeeper)
. .	1 Quej
. .	. .
. .	1 Junajpu
. .	8 Quej
. .	1 Aj
. .	8 Junajpu
. .	1 Came
. .	8 Aj
1 Cawuk	1 Cawuk
. .	8 Came
1 E	1 E
8 Cawuk	. .
1 Can	. .
8 E	. .
1 Tijax	. .
8 Can	. .
1 Batz'	. .
1 C'at	. .

Fig 2

BACKPACK	WASHING THE SHRINE
. .	1 Toj
. .	. .
. .	1 Ik'
. .	8 Toj
. .	1 Tz'iquin
. .	8 Ik'
. .	1 K'anil
. .	8 Tz'iquin
. .	1 Imox
. .	8 K'anil
. .	1 Ix
. .	8 Imox
1 Quej	1 Quej
. .	8 Ix
1 Junajpu	1 Junajpu
8 Quej	8 Quej
1 Aj	1 Aj
8 Junajpu	8 Junajpu
1 Came	1 Came
8 Aj	8 Aj
1 Cawuk	1 Cawuk
8 Came	8 Came
1 E	1 E
8 Cawuk	8 Cawuk
1 Can	1 Can
8 E	8 E
1 Tijax	1 Tijax
8 Can	8 Can
1 Batz'	1 Batz'
8 Tijax	. .
1 C'at	. .
8 Batz'	. .
1 No'j	. .
8 C'at	. .
1 Tz'i'	. .
8 No'j	. .
1 Ak'abal	. .
8 Tz'i'	. .
1 Ajmac	. .
8 Ak'abal	. .
1 Toj	. .

ARTURO PONCE DE LEON H.

Fechamiento arqueoastronómico en el altiplano de México

El siguiente estudio* pretende como objetivo general aportar algunas ideas que sirvan en la investigación y análisis de los elementos arquitectónicos y espacios urbanos prehispánicos proponiendo estos como instrumentos para el conteo del tiempo; mediante la posible observancia de las posiciones solares en el horizonte, señaladas por las orientaciones de dichos elementos.

En razón de la mecánica que se establece para el conteo del tiempo mediante las estructuras piramidales, es posible aproximar o comprobar la época de construcción de estos monumentos; es decir fecharlos arqueoastronómicamente. Dicho sea de paso también comprueba el "aparente" desfasamiento del calendario nahuatl, con respecto al movimiento solar medio y propone, a diferencia del criterio "europeo" a base de intercalación de días, el ajuste "físico-calendárico" a base de la medición del número de días desfasados, mediante el cambio de orientación de las pirámides, por ende el cambio de la posición solar en el horizonte. Semejante esto a la corrección o serie secundaria del calendario maya: ya que si ésta medía los días calendáricos desfasados respecto a un origen, las diferentes orientaciones de los sitios prehispánicos medían físicamente este mismo desfasamiento, con lo cual era posible predecir las estaciones y ciclos agrícolas.

En el altiplano de México existen muchos lugares cuyas características de trazo, ubicación y realización arquitectónica, están relacionadas con ciertas condiciones de tipo orográfico y astronómico, esto es, en su construcción indudablemente algo tiene que ver que el eje de una construcción apunte a un cerro y que éste sea referencia a la ubicación de un cuerpo celeste, generalmente el sol, en una fecha determinada.[1] En general la arquitectura ceremonial en la América antigua tiene un carácter esencialmente solar si bien estos edificios tienen algunas relaciones con la culminación, puntos de ocultación o apariciones helíacas de algunas estrellas (Marquina 1934; Aveni 1977, 1980), el carácter más importante de estos edificios es el solar; como lo sugiere la regla general en su orientación oriente-poniente, la cual no obstante su variedad de unos edificios a otros, en muy raros casos, señala más allá de los puntos en que se observa el sol en el horizonte.[2]

Los ejes de sus estructuras indican exactamente los puntos de su registro solar.[3] Llamamos días de registro solar a cuatro días del año, dos al amanecer cuando el sol en su movimiento aparente

* Las fotos citadas más abajo pertenecen a la colección del autor.

recorre el hemisferio sur y dos al atardecer cuando el sol recorre el hemisferio norte. Dicho de otra forma, el eje de la estructura señala cuatro fechas, en las que el sol aparece o desaparece en el horizonte excatamente en el punto indicado por el eje. Por ejemplo: una estructura que tenga 17^{o} de orientación al sur del oriente, registrará al oriente la salida del sol, los primeros días de febrero y noviembre, cuando el sol recorre el hemisferio sur y al poniente el ocultamiento del sol los primeros días de mayo y agosto, cuando el sol recorre el hemisferio norte.

Existe una relación entre los "días de registro solar" de estas estructuras y la posición de la tierra en su eje de traslación alrededor del sol; si arbitrariamente dividimos en cuatro los posible movimientos de la tierra alrededor del sol, serán cuatro los posibles días de registro solar, así el sol deberá registrarse en el horizonte dos días al amanecer y dos días al atardecer, como en el ejemplo anterior.

La orientación de cada centro ceremonial, entonces, nos indica cuál es su registro solar; pero si comparamos los registros solares de cada centro, esto es la dirección de sus ejes, podremos notar sensibles diferencias. ¿Tiene esto alguna explicación? ¿Cuál fue la razón de estas diferencias? Existen varios estudios sobre las relaciones astronómicas de diferentes sitios o estructuras en particular, pero considero principalmente cuatro los autores que han analizado el tema desde el punto de vista global y genérico, proponiendo las razones en la variedad de las orientaciones. Escalona Ramos (1940) menciona que las orientaciones varían con el tiempo a razón de un grado cada 260 años y fija el origen de estas orientaciones al corriente-poniente astronómico, por el año 2914 a.C., con lo cual dice el investigador se puede determinar la época aproximada de la fundación de una ciudad o de la construcción de un edificio, sabiendo la orientación de su eje principal. F. Tichy (1976), al investigar la región de Puebla, forma tres familias de distintas alineaciones, con lo cual propone que las variaciones en las orientaciones, responden a un módulo angular mesoamericano de 4.5^{o} como veinteava parte de 90^{o}, submúltiplo ideal de un sistema vigesimal. Anthony Aveni (1977) estudia un grupo de orientaciones de 17^{o} entre otras y el ajuste casi perfecto en Teotihuacan con la posición de la puesta en el horizonte de las pléyades, así como la salida helíaca de este mismo grupo de estrellas el día en que ocurría el primero de los dos tránsitos del sol por el cenit de Teotihuacan, la ciudad más grande e influyente de las ciudades contemporáneas de la antigua América. También propone la relación de fechas agrícolas, con la posición de salida o puesta del sol en los sitios con orientaciones de mayor desviación. Fujisyoshi Yoshio (1981) relaciona diferentes sitios arqueológicos de todo el mundo y establece en base a los períodos agrícolas, diferentes según zonas geográficas, que las orientaciones en general señalan la posición solar en el horizonte, los meses de mayo y junio.

Las ideas hasta ahora más significativas para el enfoque del presente estudio, o sea la señalización solar en el horizonte, mediante la orientación de las estructuras, pienso que puedan ser las enunciadas por estos investigadores. Si para Escalona las orientaciones van cambiando sistemáticamente, un grado cada 260

años, a partir del año 2914 a.C., entonces el grupo de sitios con orientaciones de mayor desviación (20^{o} a 25^{o}) por ejemplo, tendrán que construirse entre el año 2286 d.C. al 3686 d.C., cosa que sale fuera de la realidad. En cambio Aveni, Tichy y Yoshio, suponen que las orientaciones de los centros ceremoniales, se han definido con cierta variedad preestablecida, siendo la idea en común para estos investigadores el considerarle a la diversidad de orientaciones un medio con el cual fijar un calendario agrícola.

Ahora bien, basándonos en la idea de que una estructura señala cuatro fechas mediante una misma orientación, vamos a desarrollar varias alternativas, que relacionen el tiempo probable de fabricación del monumento con sus días de registro solar. Para lo cual vamos a utilizar una gráfica circular (véase lámina 1) que señala en el sentido angular la ascensión recta del sol y, en el sentido concéntrico, las épocas culturales. Así de esta forma podremos graficar la posición de la tierra en la eclíptica los días en que las estructuras piramidales, según su época de fabricación, señalan en el horizonte la salida u ocultamiento del sol. Para la primera alternativa vamos a suponer, de los cuatro registros de cada estructura, los dos que corresponden al poniente,[4] es decir las orientaciones que señalan el ocultamiento del sol en el horizonte dos veces al año, una cuando el sol va de primavera a verano (véase Graf. 1A en lámina 1) y otra cuando el sol va de verano a otoño (véase Graf. 1B en lámina 1). Para la segunda alternativa vamos a suponer los otros registros solares de cada edificio que señalan al oriente la aparición del sol en el horizonte, también dos veces al año, cuando el sol va de invierno a primavera (véase Graf. 2A en lámina 1) y cuando va de otoño a invierno (véase Graf. 2B en lámina 1).

Las siguientes dos alternativas suponen uno de los cuatro registros de cada estructura y les consideran una secuencia temporal respecto a las estaciones, así en la tercera alternativa (véase Graf. 3A en lámina 1) que hemos denominado "secuencial directa" los edificios registran primeramente en verano, posteriormente en otoño, invierno, primavera, verano nuevamente y por último otra vez en otoño, siguiendo el sentido de las estaciones. En la cuarta alternativa (véase Graf. 3B en lámina 1) "secuencial inversa", los registros solares son en primavera, invierno, otoño, verano, primavera nuevamente y por último otra vez en invierno siguiendo el sentido inverso a las estaciones. El análisis de las posibles alternativas de registro solar, centrando nuestra atención en las dos últimas que presentan una secuencia lógica, nos permite establecer que estas diferencias se deben a que cada centro ceremonial fija la orientación de su eje en distintas fechas, esto es, observando el sol en diversos momentos de su movimiento aparente.

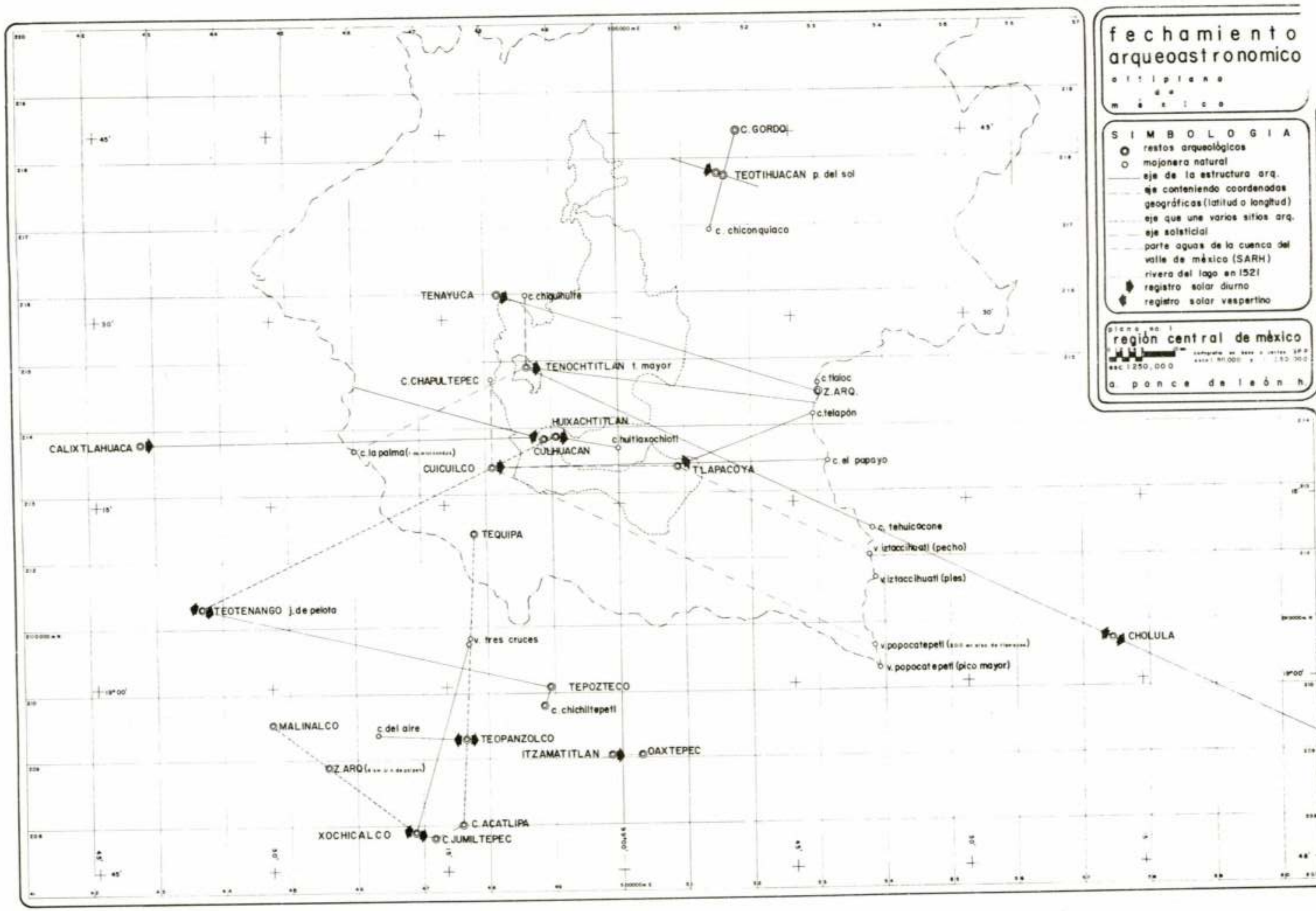
Las fechas de registro solar guardan, entonces, una correspondencia con el órden de las estaciones del año conforme pasan los siglos. Esto nos lleva a relacionar los monumentos arqueológicos con el cómputo del tiempo. Los centros ceremoniales y el calendario se conjuntan en una importante celebración: el Fuego Nuevo (Palacios 1934, Saenz 1967, García 1975). Si como hemos visto, el "Fuego Nuevo" se registraba por la orientación

axial de las estructuras y si éstas se iban orientando de diferente forma, a manera que los registros solares iban sucediéndose en diferentes meses del año, según como iba pasando el tiempo. ¿Será posible pensar que estas celebraciones cíclicas de cada 52 años también se iban llevando a cabo en meses diferentes y no siempre en el mismo mes? El diferente registro solar de cada centro ceremonial nos indicaría en consecuencia que la ceremonia del Fuego Nuevo se efectuaba en diferentes fechas.[5] A esta misma conclusión llega el Dr. Alfonso Caso (1968), proponiendo el desfasamiento de las celebraciones del "Fuego Nuevo", conforme pasan los siglos. Para una mejor comprensión de esto vamos a analizar de qué forma sucede.

Son dos los aspectos más importantes en la cronología de Alfonso Caso, la colocación del día portador del año, que lo considera no al principio del año, sino al final de la XVIII veintena y la no inclusión del día correctivo equivalente al día bisiesto europeo.[6] El año indígena de 365 días, según Alfonso Caso, no se ajustaba con días agregados a lo largo del siglo, por eso cada fiesta de Fuego Nuevo se adelantaba 13 días aproximadamente, es decir se desfasaba con respecto al año solar medio, también en el sentido inverso a las estaciones. Si los centros ceremoniales y el calendario cambiaban sus fechas de celebración cada 52 años de manera inversa al sentido temporal de las estaciones del año, por ejemplo: si el Fuego Nuevo y la orientación del templo se fijaban a fines de mayo, conforme pasaban los siglos iban registrándose ambos en abril, marzo, febrero etc.

Alfonso Caso pudo establecer que el último Fuego Nuevo fue celebrado el 31 de enero gregoriano de 1508,[7] a partir de esta fecha se puede graficar retrospectivamente cada ciclo de 52 años. El siguiente paso consiste en compasar las fechas de registro solar de cada sitio, según la alternativa "secuencial inversa" (véase lámina 1) con las fechas de cada Fuego Nuevo. En esta gráfica se puede constatar la relación que existe entre la variación de los registros solares y las celebraciones de ciclos calendáricos de cada 52 años, los dos se van desfasando en el sentido inverso de las estaciones, conforma pasan los siglos. Este desfasamiento se puede precisar, estableciendo año, mes y día en que cada ciclo se cumplió, elaborando una tabla retrospectiva de Fuegos Nuevos, según cronología de Caso (véase lámina 2). Si a esta tabla se la coteja con las fechas de registro solar y los años en que la historia y/o la arqueología sitúan a cada lugar, se verá la correspondencia que existe entre cada monumento y cada ciclo de 52 anos.

Comencemos por el Huizachtecatl en Iztapalapa (véase plano 1), el sitio en que según las fuentes se celebraba la fiesta de Fuego Nuevo,[8] todavía unos años antes de la conquista. El eje de esta estructura con 12° 15' al sur del oriente señala a la cumbre del volcán, Huitlaxochiotl, que se encuentra al norte del poblado de Tláhuac, por lo que el registro solar diurno de esta pirámide es el día 20 de febrero. Todos los historiadores coinciden que la primera celebración de Fuego Nuevo (García 1975) que se llevó a cabo en este lugar fue la que dio nombre al período de 1351 a 1403 o, según cronología de Alfonso Caso, 1352 a 1404 y como el siglo era



Plano 1 Región central de México

designado con el nombre del último año de ese siglo, la gráfica (véase lámina 2) señala el 25 de febrero de 1404 como día de la celebración del Fuego Nuevo. Esta diferencia de cinco días entre la fecha calendárica y el registro de las efemérides, se presenta en casi todas las estructuras analizadas, decimos casi, pues en ocasiones la lectura corresponde exactamente a la fecha prevista. El número de cinco días nos hace pensar en los Nemontemi, los cinco días aciagos con que finalizaba el año indígena.[9] Asimismo otra de las constantes que nos vamos a encontrar, es que la celebración del ciclo calendárico correspondiente al registro solar en los sitios, es precedido en 50 años aproximadamente por el inicio del asentamiento ya concocido, esto pudiera ser debido a que primero se realizó el poblamiento, se estudió y se afinó geográficamente la ubicación y orientación del sitio[10] y tiempo después se registró solarmente el ciclo calendárico.

El siguiente lugar que analizaremos es el Templo Mayor de Tenochtitlan; las excavaciones han revelado once etapas de construcción para la fachada principal y siete perimetrales (Matos 1981), el eje de orientación de las más recientes puede ser considerado actualmente con un valor de 7° 25',[11] prácticamente el mismo eje[12] promedio de 7° 30' que presentan las calles del centro de la Ciudad de México (véase plano 1). Siguiendo la orientación de 7.5° al sur del oriente, registramos la efeméride solar el 4 de marzo.[13] Sabemos históricamente que la ciudad de Tenochtitlan que conoció el Conquistador fue fundada en el período de 1300 a 1352,[14] y que en este año debió celebrarse el Fuego Nuevo, la fecha según la gráfica (véase lámina 2) el 9 de marzo. Una vez más la diferencia de 5 días entre ambas fechas.

En Calixtlahuaca al norte de la ciudad de Toluca, los ejes de las pirámides de Quetzalcoatl y de Tlaloc,[15] son difíciles de precisar por los paños irregulares con que cuentan; pero se pueden considerar un valor promedio de 1.5° al norte del poniente, por lo que sus registros serán a finales de marzo. Calixtlahuaca tiene un período de asentamiento que va de 1200 a 1500 de nuestra era (Piña 1963) y su registro debió efectuarse según la gráfica (véase lámina 2) por el año de 1248 el día 3 de abril, unos días después de su registro solar.

Teopanzolco situado al oriente de la ciudad de Cuernavaca (véase plano 1) tiene el eje de la estructura principal[16] orientado 2.5° al norte del poniente, señalando el pico sur del Cerro del Aire. De los dos templos que rematan la estructura, el del lado norte, de planta irregular, cuenta en cada una de sus esquinas con un pilar exterior, ligeramente separado (2 cm. aprox.) del paño del muro. El paso del sol es registrado en forma especial a través de esta separación el 29 de marzo, cuando éste se oculta atrás del Cerro del Aire. Teopanzolco está ubicado arqueológicamente hacia el año 1200 de nuestra era (Piña 1963). Según análisis retrospectivo de las fechas conmemorativas (véase lámina 2) encontramos que el 3 de abril de 1248 debió celebrarse el ciclo calendárico. Los cinco días de diferencia se vuelven a registrar.

Los lugares que veremos a continuación, igual que los dos últimos, tienen un fechamiento arqueológico que, sumado al

análisis retrospectivo de los ciclos de 52 años, servirá para corroroborar las efemérides solares. Veamos el caso de Tlapacoya (véase plano 1) ubicado a 20 km. al oriente de la Ciudad de México; una de las pocas estructuras orientadas al norte del oriente,[17] como La Venta y Cuicuilco, el eje de esta estructura señala al cerro Telapón.[18] Por la orientación 20.5° al norte del poniente su registro solar es el 24 de mayo; arqueológicamente se sitúa hacia los años 500 o 400 antes de Cristo.[19] El análisis retrospectivo (véase lámina 2) señala el 23 de mayo de 468 antes de nuestra era. La diferencia es de un día.

Cuicuilco en el sur de la ciudad de México: su orientación señala el Cerro del Papayo[20] que se encuentra en el parteaguas oriente del Valle de México, con medio grado de variación al norte del oriente,[21] registra el 23 de marzo, casi los equinoccios,[22] orientación confirmada por las estructuras prehispánicas colindantes en la Villa Olímpica;[23] la tabla retrospectiva (véase lámina 2) señala el 21 de marzo del año 208 antes de Cristo, fecha que difiere en dos días al registro de la estructura.

La Pirámide del Sol en Teotihuacan presenta algunos problemas para la medición de su eje oriente-poniente[24] por la "reconstrucción" hecha de ella pero se puede establecer aproximadamente en un órden de 17°[25] al sur del oriente que difiere a los 15° 28' de la perpendicular a la Calzada de los Muertos. Entre otras referencias, pues no mencionaremos los marcados que definen ejes de registro solsticiales y equinocciales o de paso solar cenital en la Cuenca, voy a hacer mención de la relación que guarda con la estructura que René Millón (1968) denomina Zona 31, A, B, C y D en el plano 43 y que se encuentra a 1125 metros al poniente de la Pirámide del Sol (véase plano 1) desde donde se registra la efeméride solar el 7 de febrero.[26] Arqueológicamente, la Pirámide del Sol se sitúa en el año 100 a.C., según la gráfica (véase lámina 2) corresponde al 13 de febrero del ano 52 a.C., con cinco días de diferencia.

La Pirámide de Cholula, con su eje solsticial de 25.5° aprox. al sur del oriente,[27] indica en su registro solar el 21 de diciembre (Tichy 1978). Fechada arqueológicamente en su primera etapa por el año 150 de nuestra era, según la gráfica (véase lámina 2) corresponde al 24 de diciembre del año 155 d.C.: la diferencia es de 3 días.

La Pirámide de Quetzalcoatl en Teotihuacan, orientada 16° 30' al sur del oriente, la misma que la Avenida Este-Oeste (Aveni 1977), registra la salida del sol el 30 de octubre. Fechada arqueológicamente por el 300 d.C., según tabla retrospectiva (véase lámina 2) el 3 de noviembre del año 363 d.C.; que difiere en cuatro días.

Analicemos por último la Pirámide de la Serpiente Emplumada en Xochicalco (véase plano 1) y que tiene una orientación de 16° aprox.[28] al norte del poniente[29] que indica su registro solar el 5 de agosto, situada arqueológicamente por el año 700 d.C., según análisis retrospectivo (véase lámina 2) el 7 de agosto de 727 d.C.: dos días de difencia.

En este sistema se puede observar que en un período de 1508 años se repite la fecha inicial de registro (véase lámina 2), esto es después de 29 ciclos,[30] de 52 años y se debe a que cada 52 años esta fecha se va adelantando 12.594 días[31] por no ir de acuerdo con el año solar medio (véase lámina 3). Así el desfasamiento total en 1508 años será de 365.2376 días, con una diferencia al año solar medio de 6 minutos 30 segundos (tiempo) por lo que prácticamente las fechas de registro se repiten en cada uno de los cuatro centros ceremoniales cada 1508 años. ¿Será por eso que los centros ceremoniales construídos en las cercanías de Teotihuacan quince siglos más tarde tienen una orientación similar a la de la Pirámide del Sol? (Aveni 1980) La definición de un sitio para el establecimiento humano debió de reunir una serie de condicionantes agrícolas, ecológicas, de seguridad, de pesca, de caza entre otras más, pero evidentemente también geográficas y calendáricas. Si alguno de los centros ceremoniales analizados anteriormente se hubiese situado un centenar de metros al norte o al sur, ya no se cumplirían ciertas condiciones calendáricas de su registro solar. Por ejemplo, si la Pirámide del Fuego Nuevo en Iztapalapa se hubiese construído en la base del Cerro (véase plano 1), el registro solar mediante el Cerro Huitlaxochiotl no sería en la fecha establecida; o la Pirámide de Teopanzolco, si estuviese más al sur o al norte (véase plano 1) no registraría su eje sobre el Cerro del Aire la fecha 29 de marzo. El mismo caso para Cuicuilco o la Pirámide de la Serpiente Emplumada en Xochicalco.

Todo lo anterior nos hace pensar que los conocimientos astronómicos y calendáricos debieron aparecer en el Altiplano antes de la erección de los centros ceremoniales, ya que son numerosos los sitios arqueológicos con evidentes implicaciones geográficas, astronómicas y calendáricas, que muestran señales de ocupación anteriores a la época de construcción de los sitios de culto. Sabemos que el sistema calendárico en Mesoamérica era muy semejante en su estructura, aunque la nomenclatura variara. ¿Acaso la forma de registrar el tiempo mediante la orientación de los edificios fue la misma en toda Mesoamérica?[32] ¿Se ordenarían por las mismas reglas los imponentes edificios de la Zona Maya, los de Oaxaca, los de la vertiente del Golfo de México, los que se ubican en los Altos de Guatemala o los de la Zona Andina? Al menos algunos de esos sitios apuntan esta probabilidad.

A más de los sitios analizados anteriormente, existen otros en el México antiguo que por su ocupación, orientación y época de construcción, parecen estar en el mismo contexto que hemos establecido (véase lámina 4), aunque algunos por su fechamiento hasta ahora conocido llegan a no coincidir por un margen de 50 a 150 años con los ciclos calendáricos, como Tenayuca,[33] Teotenango,[34] y el Juego de Pelota en Xochicalco (véanse fotos 16, 17 y 18). En cambio sí parecen coincidir Tepoztlan,[35] Tlateloco, Tula,[36] Culhuacan,[37] y Chalcatzingo, todos estos en el Altiplano. En el Area Maya, tenemos de Chichen Itzá el edificio de las Monjas y la Casa Colorada, con registros entre los días primeros de septiembre y los últimos de agosto, según la gráfica (véase lámina 4) por el año 600 de nuestra era, que coincide con el fechamiento conocido, también en Chichen Itzá el Castillo de Kukulcán, el Templo de los Guerreros y en Tulum el Castillo, todos estos con registros a

mediados de mayo por el ano 1100 D.C., el Juego de Pelota en Chichen Itzá de estilo Maya-Yucateco (Piña 1980) situado entre el año 1000 y el 1200 D.C., cuya orientación de 17° (Aveni 1980) registra el 4 de mayo, en forma interesante a través de sus arcos o altares superiores en los muros laterales,[38] según la tabla retrospectiva (véase lámina 4) el 11 de mayo del año 1091 D.C., lo cual concuerda con el contexto establecido.

La Venta de Tabasco con sus 8° al norte del oriente, bien podrá señalar al amanecer de los días últimos de agosto o primeros de septiembre, su fechamiento conocido de 1000 a 800 A.C., el ciclo calendárico (véase lámina 4) que según la tabla retrospectiva señala, sería el año (600 D.C. - 1500) -- 900 A.C. aproximadamente.[39]

Es criticable el hecho de presentar un contexto tan extenso, temporal y geográficamente. ¿Cómo es posible que se pueda explicar de la misma forma la razón de la orientación de los centros ceremoniales en el Preclásico, en el Clásico y en el Postclásico, cuya diferencia en el tiempo llega a más de mil años? ¿Acaso tuvieron las mismas razones, los constructores de Cuicuilco, Teotihuacan, Xochicalco y Tenochtitlan para ubicar y orientar sus templos y ciudades?

El presente estudio propone un esquema general del funcionamiento, posiblemente el más importante de los centros ceremoniales. Si estos "corregían" su orientación con respecto a los anteriores cada ciclo calendárico de 52 años prehispánicos, observando el movimiento aparente del sol en el horizonte, se puede decir entonces que el calendario prehispánico sí contenía ajustes para ir acorde al movimiento solar. Pero esta corrección no era al estilo "europeo", pues no lo admitía su sistema combinatorio (Palacios 1934; Caso 1968; Carrasco 1980). Su elemento correctivo era la medición del número de días desfasados, entre el calendario de 365 días y el año solar medio (mediante el cambio de orientación de las Pirámides) de esta forma se sabía del desplazamiento con respecto a las estaciones, con lo cual sí se podían prever los ciclos agrícolas.

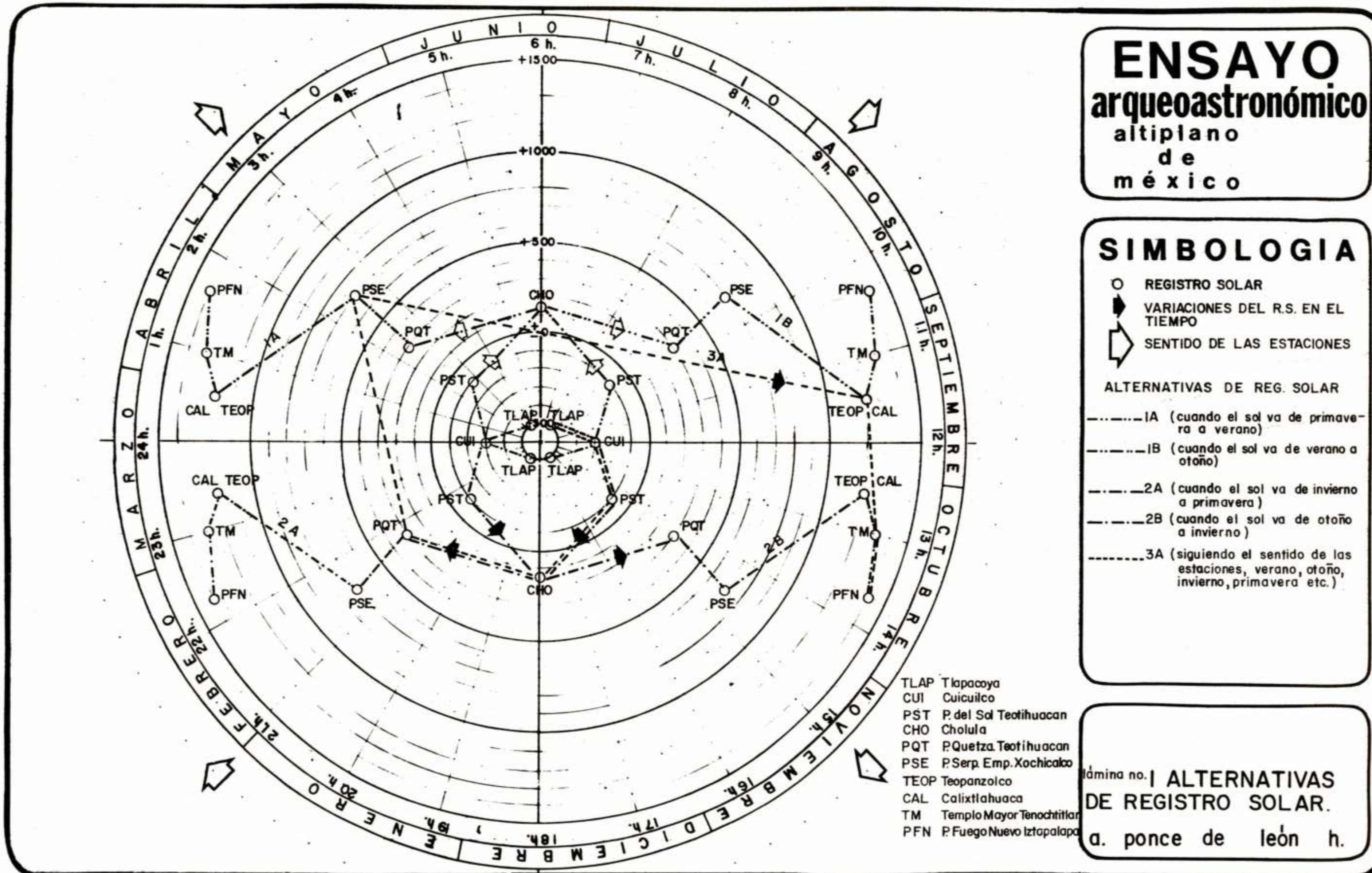


Lámina 1 Alternativas de registro solar

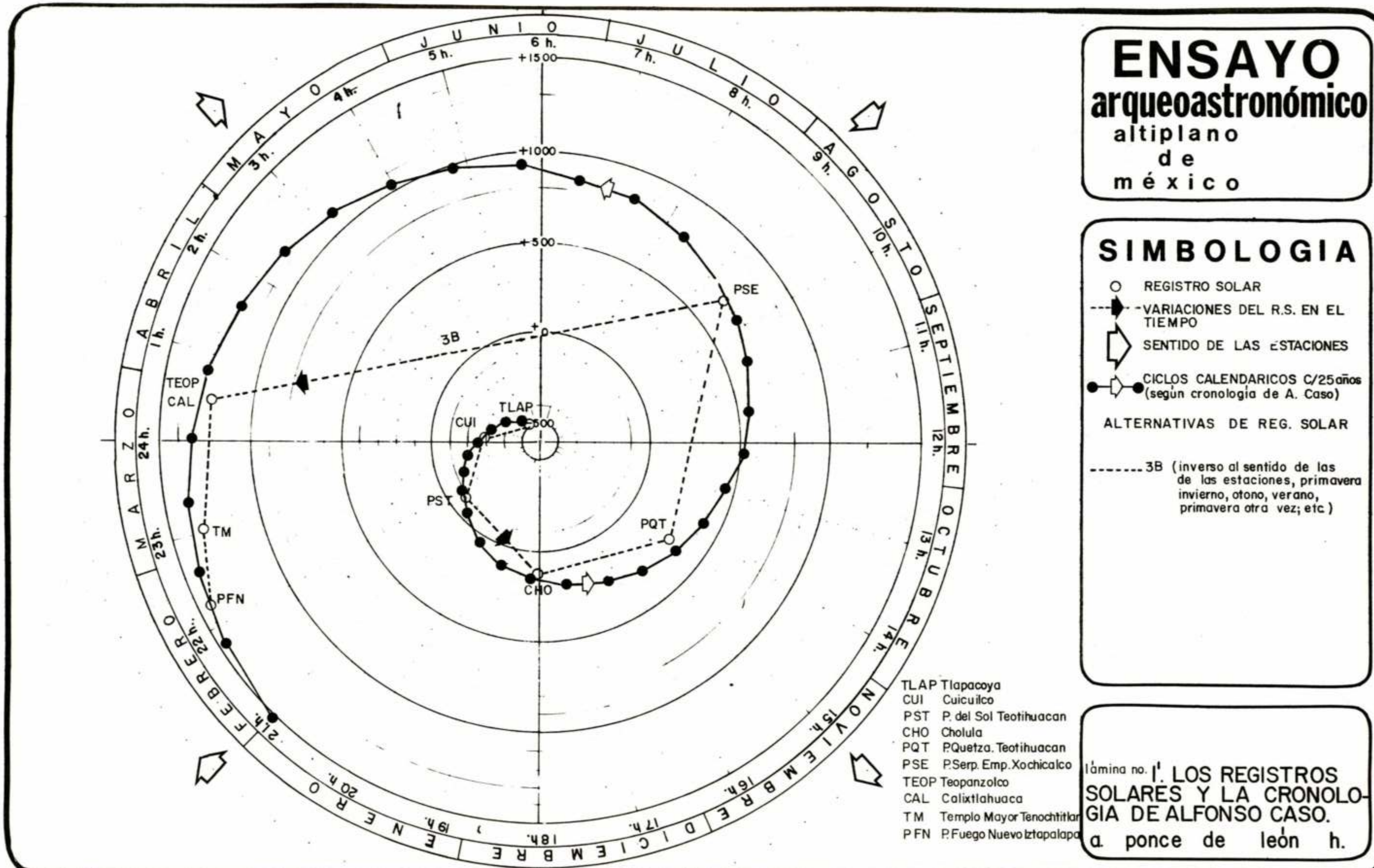
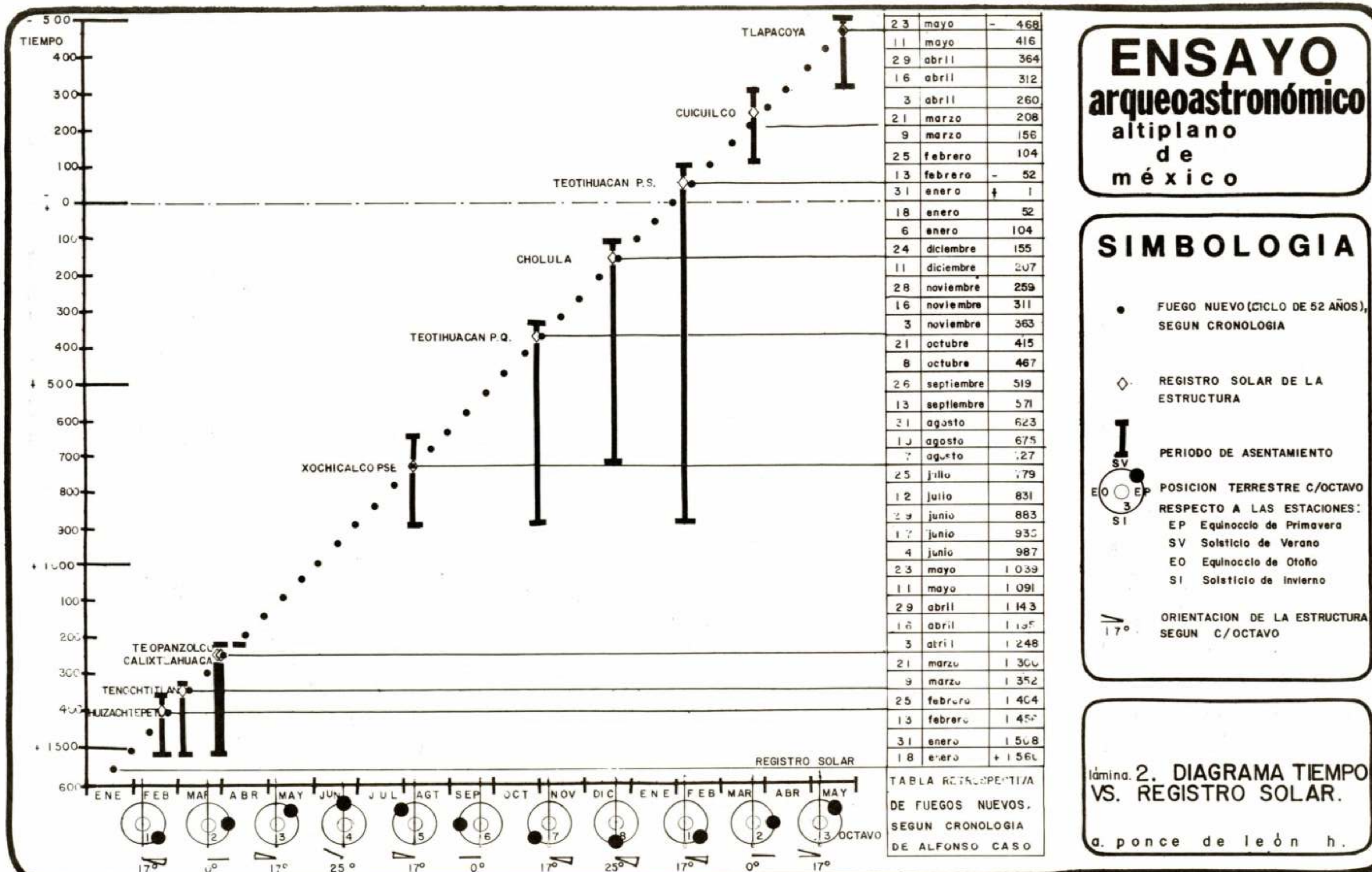


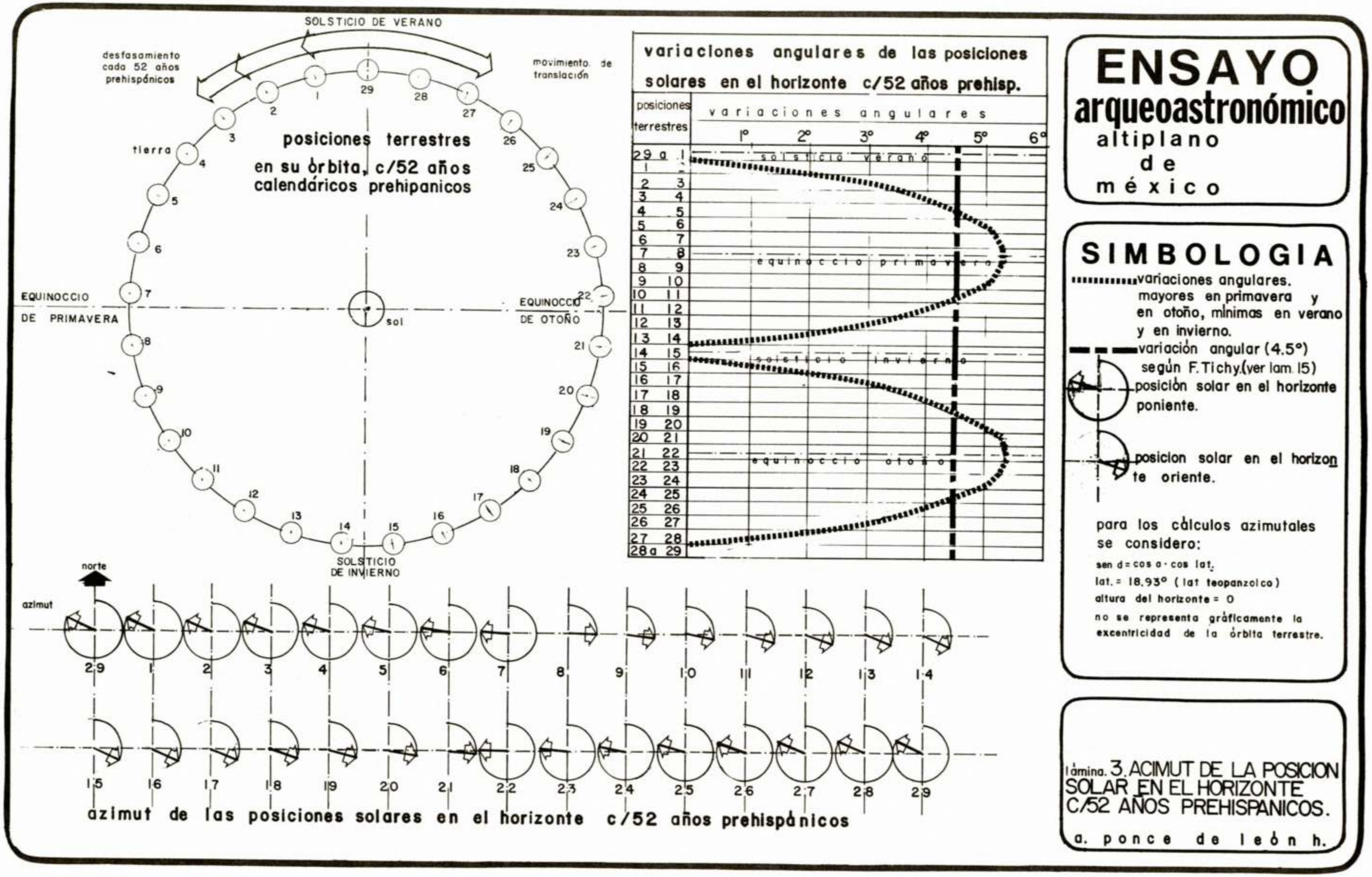
Lámina 1 (cont.) Los registros solares y la cronología de Caso



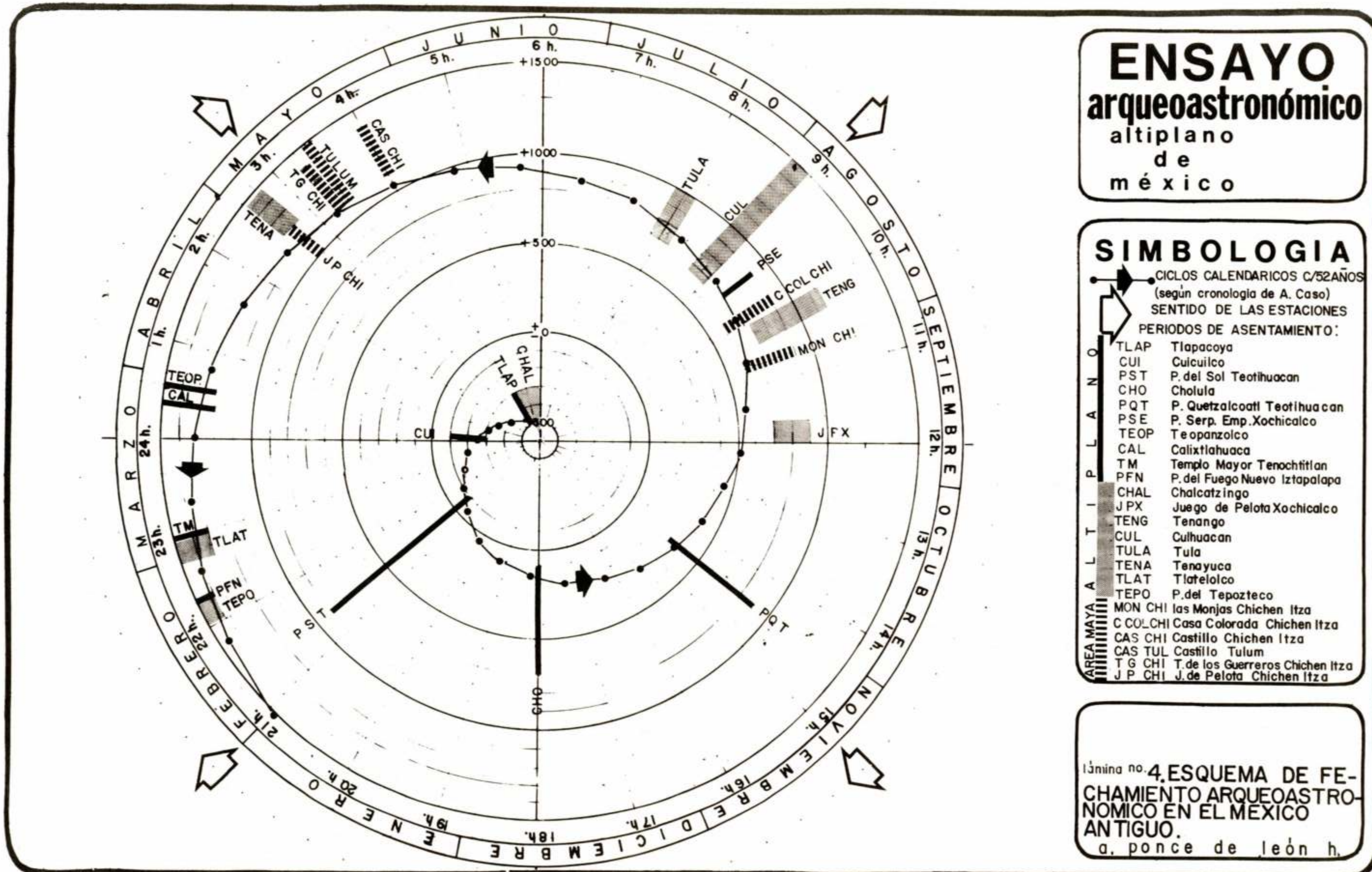
23	mayo	- 468
11	mayo	416
29	abril	364
16	abril	312
3	abril	260
21	marzo	208
9	marzo	156
25	febrero	104
13	febrero	- 52
31	enero	+ 1
18	enero	52
6	enero	104
24	diciembre	155
11	diciembre	207
28	noviembre	259
16	noviembre	311
3	noviembre	363
21	octubre	415
8	octubre	467
26	septiembre	519
13	septiembre	571
31	agosto	623
18	agosto	675
5	agosto	727
25	julio	779
12	julio	831
29	junio	883
17	junio	935
4	junio	987
23	mayo	1 039
11	mayo	1 091
29	abril	1 143
16	abril	1 195
3	abril	1 248
21	marzo	1 300
9	marzo	1 352
25	febrero	1 404
13	febrero	1 456
31	enero	1 508
18	enero	+ 1 560

TABLA RETROSPECTIVA DE FUEGOS NUEVOS, SEGUN CRONOLOGIA DE ALFONSO CASO

Lámina 2 Diagrama tiempo vs. registro solar



Lamina 3 Acimut de la posición solar en el horizonte c/52 años prehispánicos



Lamina 4 Esquema de fechamiento arqueoastronómico en el México antiguo

NOTAS

1 Como el Observatorio Astronómico (Grupo E) en Uaxactún Petén, para determinar las fechas de los solsticios y los equinoccios (Morley 1980). El Observatorio o Caracol en Chichen Itzá, para determinar las fechas de equinoccios y la puesta lunar con máxima declinación el 22 de marzo (Ricketson 1928, en Aveni 1980), así como los eventos de Venus y el sol que ocurren según 20 alineaciones arquitectónicas (Aveni, Gibbs, Hartung 1975). También las estructuras C y D en Xochicalco, señalando el ocultamiento solar en los días de posición cenital con la línea visual desde la "Estela de los glifos" hasta el canto de la base derecha de la estructura D. (Aveni 1975). La orientación de estas estructuras también señala el punto en el horizonte (Ponce de León 1982) en el que el sol se oculta 3 días después del equinoccio, señalando el cuarto submúltiplo calendárico del año. Como las estaciones no son iguales en número de días, el equinoccio no es la cuarta parte del año, sino los días señalados por estas estructuras. También es conocida históricamente la festividad de Tlacaxipehualiztli que se hacía cuando el sol estaba en medio de Huichilobos, cuyo fenómeno visual pudiera ser semejante al que se observa en Teopanzolco (véase foto 4) y que en la Ciudad de México actualmente se registra únicamente por sus calles (véase foto 7). Estelas 10 y 12 en Copan Honduras (Aveni 1980) cuyo eje señala el ocultamiento del sol los días 12 de abril y 1 de septiembre.

2 Los ejes oriente-poniente, en la gráfica que resume las orientaciones en la América antigua (Aveni 1980).

3 Se le ha llamado también "posición solar en el horizonte" (Tichy 1978).

4 Algunas estructuras (principalmente en el Preclásico) están orientadas hacia el norte del oriente, es decir registran en primavera y verano, pero al amanecer.

5 Esto difiere del concepto tradicional que desde los primeros cronistas se ha conocido (Carrasco 1980 y Caso 1968).

6 Juan Palacios en 1934 en su estudio sobre el principio del siglo indígena tampoco incluye el día bisiesto, pero como el portador lo considera el principio del año calendárico, la fecha del Fuego Nuevo último en Mesoamérica le resulta el 2 Acatl, 7 de mayo (juliano) de 1507, después al transportar la fiesta del 2 Acatl al 4 Acatl (según Chimalpain) obtiene el 26 de julio del mismo año, (80 días después) día del segundo paso cenital en Tenayuca.

7 Difiere del dato (1507) que tradicionalmente se ha conocido, porque el portador del año 3 Calli (año en que es conquistada definitivamente Tenochtitlan) resulta en 1522 y no en 1521, ya que al considerar este portador al final y no al principio del año prehispánico, resulta que al año cristiano de 1521, termina 18 días antes del día 3 Calli por lo que éste cae al 18 de enero de 1522 (juliano), equivalente al 27 de enero del año gregoriano de 1522, continuando con esta correlación (sin la inclusión de días bisiestos) se deduce que la fecha cristiana en que se celebró el último Fuego Nuevo, que dio nombre al anterior ciclo de 52 años, fue el día 31 de enero del año 1508.

8 Tezozomoc (García 1975) señala los lugares donde descendió el Fuego Nuevo o se "ataron los años": 1090 en Acahualitzingo; 1142 en Coatepec; 1194 en Tecpayoacan-- hasta aquí en años Cetochtli-- 1247 en Chapultepec; 1299 en Culhuacan y de la sexta en adelante, ya no las precisa. Chimalpain dice (García 1975): "nuestros años se atan en la cumbre del Huizachtecatl, cae-- el fuego-- en el encendedor de barrena".

9 Si el portador del año 2 Acatl, fuese el día último de los Nemontemi (25 de febrero de 1404) entonces el registro solar de la estructura cinco días antes 10 Tochtli (20 de febrero de 1404), tendría el lugar último del mes XVIII que en la cronología de Caso lo ocupa el portador 2 Acatl.

10 ¿Podría ser acaso ésta una de las razones de la peregrinación azteca?

11 Los valores dados hasta antes de las excavaciones han sido: 7° 30' (Aveni 1977) y 7° 00' (Tichy 1978). Los resultados obtenidos en marzo de 1981 por quien esto escribe, en la realización de las mediciones acimutales de los ejes principales y de las estructuras visibles (en esa etapa de las investigaciones) del Templo Mayor y las diferencias que entre sí guardaban entonces, son los siguientes. Para la segunda fase constructiva (misma que cuenta, aún con los dos templetes) se midieron dos ejes. El eje superior que pasa en medio de los dos templos, y el eje virtual inferior que va de la parte media inferior (entre las dos escaleras en el nivel de desplante de éstas) hacia la parte media de la entre calle (ranura o junta) opuesta a las escaleras en el nivel de desplante actual del monumento. Para el primero el valor resultante fue de 97° 25' (medido a partir del norte astronómico) y para el segundo de 98° 48'. Es de considerar que el desplome que presentan las fachadas oriente y poniente de dicha fase constructiva fue motivado por el "bufamiento" del terreno cuyo comportamiento no ha sido homogéneo en toda la superficie de las excavaciones, encontrándose que la mayor elevación o bufamiento se ha registrado en la parte sureste del monumento, razón por la cual se ha propiciado una diferencia acimutal entre los ejes mencionados de la estructura. Para las últimas etapas constructivas de la fachada principal, consideradas a partir de la tercera fase, el eje que se ha logrado

medir hasta la fecha es el que va sobre la parte media superior (entre las dos escaleras) de cada una de las estructuras. Este eje presenta una medición de 96° 02' con una diferencia aproximada de - 1° 23' con respecto al eje superior de la segunda fase y de - 2° 46' con relación al eje interior de la misma. Si consideramos que estas últimas fases fueron afectadas también por el levantamiento del terreno al faltar la carga con la que estaba trabajando antes de iniciar las excavaciones, es de suponer que exista un esviaje (semejante al existente en la segunda fase) entre el eje superior, con respecto al inferior o sea que si a la medición realizada de 96° 02' le adicionamos la diferencia obtenida (1° 23') que existe con respecto a la segunda fase, nos dará un valor para este eje superior de 97° 25'. Por otro lado es congruente que los ejes principales de la traza colonial de la Ciudad de México tuviesen la misma orientación que la última fase constructiva prehispánica o sea 97° 30' (promedio) que es prácticamente el mismo de 97° 25' supuesto por comparación deductiva con respecto a la segunda fase.

Conclusiones:

I El eje del pasillo de la segunda fase (perimetral) se puede considerar con un valor original cercano a los 98° 48'.

II Los muros oriente y poniente tienen 7° 30', los muros norte y sur tienen 97° 30'; por lo que el pasillo central queda descuadrado con respecto a la estructura.

III El eje, desde la tercera fase hasta la última fase, se puede considerar con un valor original a los 97° 25'.

IV El Templo Mayor presenta un esviaje en los ejes oriente-poniente de la segunda fase (pasillo central) con respecto al eje que comprende las fases posteriores (de la tercera a la última) cuyo valor aproximado es de 1° 23'.

V Pensando en que la orientación del pasillo central de la segunda fase señalará la posición solar en el horizonte, serían cuatro los días señalados: al oriente 28-29 de febrero y 10 de octubre y al poniente el 24 de septiembre y el 10 de abril. Visto esto bajo el contexto establecido (véase lámina 4) la primera fecha nos indicaría que la segunda fase se habría construído por el año 1400 d.C., después de la 3a. fase, lo cual es incongruente. La segunda fecha nos indicaría que esta fase se hubiese construído por el 500 d.C., cosa que también es improbable, pero la cuarta fecha, por el año 1200 d.C. se aproxima a lo que mencionan algunos investigadores (Vega 1979) sobre el asentamiento anterior a la fundación por los aztecas.

12 Además existen varios ejes en la Ciudad de México, cuyo trazo urbano es herencia en gran medida de la antigua ciudad de Tenochtitlan, que presenta como muchos sitios en Mesoamérica una relación de ubicación con respecto a otros lugares. Así, el lugar del Templo Mayor se encuentra definido posiblemente por tres ejes. El de la original Calzada de Tenayuca (González 1973), hoy Calzada de Vallejo, que unía la Pirámide de Tenayuca, Tlateloco,

el Templo Mayor de Tenochtitlan, el Capulli, Zoquiapan, la que fuera isleta de Acolco, y remataba en el centro de Huixachtitlan, uniendo estos sitios en forma simbólica y física. Otro eje que posiblemente define la ubicación de esta antigua ciudad (véase plano 1) es el que contiene la traza del centro ceremonial y ciudad de Cholula en Puebla (Ponce de León 1982), cuyo rumbo astronómico señala el solsticio de invierno, este eje después de señalar en el porteaguas de la Cuenca, el cerro Tehuicocone como mojonera natural, cruza por el Templo Mayor. El tercer eje propuesto para esta ciudad (véase plano 1), es aquel que va del Templo Mayor al cerro de Chiquihuite (Ponce de León 1982), que definiría el norte astronómico, es decir, las estrellas situadas arriba de la cumbre del cerro girarían alrededor de un punto situado sobre este mismo, visto desde el Templo Mayor.

13 Esta fecha ya había sido mencionada, así como las correspondientes, 10 de octubre, 6 de septiembre y 6 de abril (Tichy 1978).

14 Según las fuentes el año fue 1325, pero, aplicando la cronología de Alfonso Caso, el año 2 Calli es el 1326 y esto es por la posición del portador del año (véase nota 7).

15 La orientación de los diferentes paños por ejemplo en la Pirámide de Quetzalcoatl varían de 0^{o} a 2^{o} 17' al sur del oriente, por lo que tomamos el promedio entre 1^{o} 12' y 1^{o} 50' (Aveni 1980).

16 El otro eje, norte-sur, de esta estructura cruza por los siguientes sitios (Ponce de León 1982): principia al sur en el cerro Acatipa (véase plano 1) que contiene restos arqueológicos, sigue al norte por la Pirámide de Teopanzolco, continúa más al norte por el volcán Tres Cruces (por el que también cruza el eje norte-sur de la Serpiente Emplumada de Xochicalco) (véase nota 28) y termina en la Pirámide de Téquipa al sureste del pueblo del Ajusco. De esta forma, este eje une tres sitios arqueológicos, dos en el Valle de Cuauhnahuac y uno en el Valle de México. Esta unión de tres sitios arqueológicos, por el mismo eje, no es el único caso en el Altiplano, ya que Teotenango, Cuicuilco y la Pirámide del Fuego Nuevo en Iztapalapa (Ponce de León 1982) son unidos por un eje solsticial (véase nota 20). El mismo caso es el eje que une Malinalco, La Pirámide de Palpan de Baranda y Xochicalco (Ponce de León 1982). El significado de esta unión, quizá simbólica, de sitios arqueológicos de diferentes épocas culturales, no la sabemos pero dudamos sea circunstancial.

17 En general la orientación de las estructuras piramidales en Mesoamérica se presenta de la siguiente forma. Cuando es al oriente, señala hacia el sur-oriente y cuando es al poniente señala nor-poniente, pero Tlapacoya, como algunas otras, mira hacia el nor-oriente y al sur-poniente. Este grupo de orientaciones tienen en común el pertenecer al Preclásico (véase nota 4).

18 Como la Pirámide de Tlapacoya está en la ladera nor-oriente del cerro no es posible visar el horizonte poniente, ya que lo obstruye el cerro, siendo visible únicamente el horizonte oriente.

19 Si bien el período de asentamiento en Tlapacoya se prolonga hasta el período azteca, el inicio de éste es en el Preclásico (Piña 1963).

20 Se puede decir que en la Pirámide redonda de Cuicuilco se manifiestan tres tipos de ejes: el que señalan las rampas oriente-poniente, 0^{o} 30', el de la tumba superior 18^{o} aprox. y el de la tumba inferior con 26^{o} aprox. al norte del oriente los tres. Por la diferencia de ejes en la misma estructura y bajo el contexto de la variación de orientaciones conforme pasa el tiempo, parece congruente el que la tumba inferior, construída primeramente, registre solisticialmente en junio (como el eje Iztapalapa-Cuicuilco-Teotenango) (véase nota 16), la tumba superior (construída después) registre en mayo y la estructura que presenta las rampas (construídas en los últimos años de su ocupación) registre en marzo, siguiendo el sentido inverso a las estaciones.

21 La rampa poniente presenta tres escalones cuyas orientaciones varían de 2^{o} a 8^{o} al oriente del norte, por lo que las perpendiculares a estas terrazas serían de 92^{o} a 98^{o} aprox., que coinciden con los valores asignados a esta pirámide: 97^{o} 38', 95^{o} 42' y 91^{o} 43' (Aveni 1980).

22 En el Altiplano no se han identificado estructuras que registren la posición solar en el horizonte exactamente el día del equinoccio; las estructuras con registro más cercano pueden ser: el Juego de Pelota en Xochicalco (véanse fotos 16, 17 y 18), las estructuras C y D también en Xochicalco, la Pirámide que se encuentra junto a la Alberca de Villa Olímpica, que aún cuenta con el desplante de muros estucados y cuya orientación difiere en 0.5 grado al oriente poniente astronómico. Esto nos hace pensar en la división del "año numérico" o "días de mitad del año" (Tichy 1978; Carrasco 1980) correspondientes al 24 de marzo y 20 de septiembre, intervalo más sencillo entre el solsticio estival e invernal. El Templo Mayor de Tenochtitlan pudo haber registrado el equinoccio mediante la posición solar con 22^{o} de altura sobre el horizonte (Aveni 1978; véase también foto 4). En la zona maya sí parecen existir edificios que registran este día, y son bastante conocidos en Chichen Itzá, Uaxactún etc.

23 Actualmente la efeméride solar oriente de la estructura más importante en Villa Olímpica, que aún cuenta con paños de muros confiables, desgraciadamente no se puede observar, pues la obstruyen los edificios colindantes a la Pirámide; pero en base al cálculo hecho mediante la resolución del triángulo astronómico, por lecturas solares, se puede decir que este registro solar se lleva a

cabo también tres días después del equinoccio de primavera (véase nota 22).

24 Mediante análisis de fotos aéreas estereoscópicas y cartografías (SDM. SPP. CAVM) se puede apreciar, en conjunto, una desviación en la orientación de la Pirámide del Sol con respecto a la Calzada de los Muertos o inclusive con la Avenida Este-Oeste. Pero la comprobación física, mediante la medición topográfica que hemos llevado a cabo, refleja variaciones en los diferentes paños.

25 Parece coincidir con la orientación de la Ciudadela, 16° 55' al sur del oriente (Aveni 1980). Millón (1968) le atribuye la misma orientación a la Pirámide del Sol y a la Calzada de los Muertos. Marquina (1964) le asigna aproximadamente 17°; Aveni (1980) no le asigna valor y Gaitán (1974) le asigna 16° 30'.

26 Para este tipo de orientaciones (17°) se le asigna como fechas de registro (Tichy 1978) el 4 de febrero, 5 de mayo, 8 de agosto y 7 de noviembre, que definen ocho períodos del calendario numérico (Carrasco 1980).

27 Tichy le asigna 25° (Tichy 1978) y Aveni según varias faces: 26° 16', 24° 15', 23° 47', 25° 32' y 25° 38'.

28 El eje oriente-poniente de esta pirámide (véase plano 1) queda señalado al oriente por el cerro Jumiltepec (Ponce de León 1982) cuya cumbre contiene restos de edificios prehispánicos rodeados por un foso perimetral que circunda el sitio. La cornisa norte mide 105° 39', la sur 106° 09', lo que promedia 105° 54' (106 aprox.), lo cual concuerda con el registro solar al oriente, constatado fotográficamente (véanse fotos 1, 2 y 3). Por fases Aveni mide 276° 45' y 277° 13' (Aveni 1980). De forma semejante a la Pirámide de Teopanzolco el eje norte de esta pirámide senala al Cerro de Tres Cumbres, en la parte más alta de la sierra que separa el Valle de Cuauhnahuac del Valle de México (véase nota 16).

29 Al poniente de la Pirámide de la Serpiente Emplumada, se encuentra una estructura más alta cuya orientación varía 0.5 grado hacia el norte del poniente con respecto a la Pirámide de la Serpiente Emplumada. La razón de esto podría ser por la diferencia de altura entre las dos estructuras, ya que el sol cuando se oculta el 5 de agosto, visto desde la Pirámide Serpiente Emplumada se alinea al eje de ésta antes de ocultarse, pues desde ésta no se observa el horizonte; en cambio, desde la estructura poniente, sí se observa el horizonte; pero cuando el sol ya se oculta con 0.5 grado más de orientación al norte del poniente.

30 En 1508 años solares medios (de 365.2422 días) el número total de días serán 550,785.2376 y en 1508 años calendáricos

prehispánicos (de 365 días) serán 550,420 días siendo la diferencia 365.2376 días. Es decir, si cada 52 años se hacía una corrección en los "registros solares" (véase lámina 3), cambiando su orientación con respecto a la anterior, se puede considerar que el calendario prehispánico sí contenía correcciones para ir acorde con el movimiento solar; pero este ajuste no era el estilo "europeo", ya que no lo admitía su sistema combinatorio (Palacios 1934; Caso 1968; Carrasco 1980). Su elemento correctivo era la medición del número de días del desfasamiento entre el calendario de 365 días y el año solar medio de esta forma si se tenía conocimiento de los días que se desfasaba el calendario con respecto a las estaciones por lo que sí se podían prever los "ciclos agrícolas".

31 La diferencia de 12.594 días en la posición solar en el horizonte produce una variación angular en las orientaciones de la Pirámide, que no es homogénea (véase lámina 3), pues el movimiento aparente del sol en el horizonte es mayor en los equinoccios que en los solsticios. Esto es al considerar como unidad base el "tiempo", diferente a la unidad "ángulo" propuesta por Tichy (1978).

32 Al menos la calendárica mesoamericana puede ser considerada como evidencia de la actividad astronómica (Gibbs 1977).

33 El registro solar en Tenayuca es el 7 de mayo, que difiere en 80 días al supuesto (26 de julio) por Marquina (1934). Este autor le asigna una orientación de 20^{o} 47' al norte del poniente, la estructura en realidad tiene 17^{o} 42' (Aveni 1980), es decir 3^{o} menos; por lo que el día de paso solar cenital, el sol no es señalado en el horizonte por el eje de la Pirámide.

34 El registro del sitio sería al poniente, con la posición solar senalada minutos antes de su ocultación, semejante a la Pirámide de la Serpiente Emplumada en Xochicalco (véase nota 28).

35 El eje poniente con 17^{o} 42' al norte del poniente (Aveni 1980) registra casi a mediados de mayo. Pero al oriente, por la altura del cerro (lo mismo que en Teotenango y en la Pirámide de la Serpiente Emplumada en Xochicalco; véanse notas 28 y 34), el sol incide sobre el eje a mediados de febrero. El eje norte-sur de esta estructura señala al cerro Chichiltepetl.

36 Aquí en Tula, lo mismo que en Xochicalco, Teotenango y Tepoztlan (véanse notas 28, 34 y 35), por estar al horizonte-poniente más alto de lo común el registro es en los últimos días de julio y no a principios de agosto, según los 17^{o} aprox. al norte del horizonte.

37 El convento de Culhuacan está edificado sobre restos arqueológicos, cuya cerámica abarca desde Teotihuacan IV hasta el Azteca I (Sejourné 1970). Desde la colonia, iglesia y convento figuran como parte del pueblo de Culhuacan. Puesto que los conquistadores elevaban siempre las iglesias en lugares ya consagrados, con la intención de transferir sobre ellas un antiguo prestigio, es improbable que monumentos tan costosos hayan sido edificados en un lugar abandonado, desprovisto por consecuencia de fuerza social. Es seguro que el eje de las ruinas de la primera iglesia sea el mismo que el de la estructura prehispánica, como en otros muchos sitios, ya que los ejes de trazo de los sitios coloniales vienen siendo los mismos que los prehispánicos, como en la Ciudad de México. La orientación de las ruinas de la primera iglesia, 18° 50' aprox. al norte del poniente, registra los primeros días de agosto. La fecha que de la fundación de Culhuacan transmite Chimalpain (Sejourné 1970) 670-10 Tochtli conviene perfectamente al Teotihuacan IV (Sejourné 1970) y debe anteceder en 50 años aprox. a la celebración del ciclo calendárico en ese sitio, según gráfica (véase lámina 2) el 7 de agosto del año 727 d.C., lo cual concuerda con lo planteado (véase lámina 4).

38 La función asignada a estos elementos ha sido la de ser recintos para sacerdotes o personajes principales (Pina 1980).

39 Dado que nuestra gráfica (véase lámina 4) no reporta años anteriores al 500 a.C., para encontrar a qué año corresponde el registro solar, el cálculo lo hacemos de la siguiente forma: los primeros días de septiembre en nuestra gráfica (véase lámina 4) serían registradas por el año 600 d.C.; como los registros se repiten cada 1508 años (véase lámina 3) el registro de la estructura debía de ser 1500 años aprox. antes del 600 d.C., es decir, el 900 a.C.

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GORDON WHITTAKER

The Structure of the Zapotec Calendar

Zapotec civilization, radiating from Monte Alban in the Valley of Oaxaca, spans virtually the entire stretch of Mesoamerican history from just after the end of the Olmec era to the rise of the Aztecs, a space of about 2000 years. Situated between the Mixe-Zoquean and Mayan cultures of Southern Mesoamerica and the diverse cultures of the North, it could well provide the key to an understanding of the development of such a significant pan-Mesoamerican trait as the 260-day divinatory calendar, for which there is abundant evidence in the Preclassic and Classic monuments of Monte Alban.

The question of whether or not the Olmecs were the inventors of the divinatory calendar will be left aside here. Suffice it to say that the earliest evidence (to date) for its use comes from Oxtotitlan in Guerrero in a clear Olmec context dated between 900 and 700 B.C. (Grove 1970: 18-20, 32). The item concerned is a painting on a cave wall depicting a cipactli-like head around which are six circles or dots (Fig. 1). It must be emphasized that an interpretation of this as a day-date or calendrical name 6 Dragon (Cipactli) is by no means firm, but the likelihood that it is indeed such is strong, and there are no compelling alternatives to this interpretation.

At this point it would be appropriate to review the basic features of the Mesoamerican calendar. The latter is composed of a sequence of numbers 1 to 13 revolving endlessly in concert with a set of 20 day-names, the resulting 260 combinations of which are grouped in 20 sets of 13 days called _trecenas_ (Fig. 2). The first day in the calendar is traditionally the equivalent of the Aztec 1 Cipactli, although other beginning points, notably Acatl, are attested in some areas. The numeral coefficient is usually placed before the day-name, but this is reversed in the Zapotec system and occasionally elsewhere.

The naming of years comes from the application of the repeating 260 day-sequence to a conventionalised, and invariable, solar year of 365 days. In the solar calendar days are grouped in 18 sets (360 days in all). Following these 18 "months", as they are called, are 5 'empty' days, the _nemontemi_ of the Aztecs and the _uayeb_ of the Maya. The solar year is named after the day in the divinatory calendar falling either:

(a) on the day following the _nemontemi_,

(b) on the last day before the _nemontemi_,

Fig 1 Painting 3, Oxtitlan (after Grove 1970: Figs. 14 and 15)

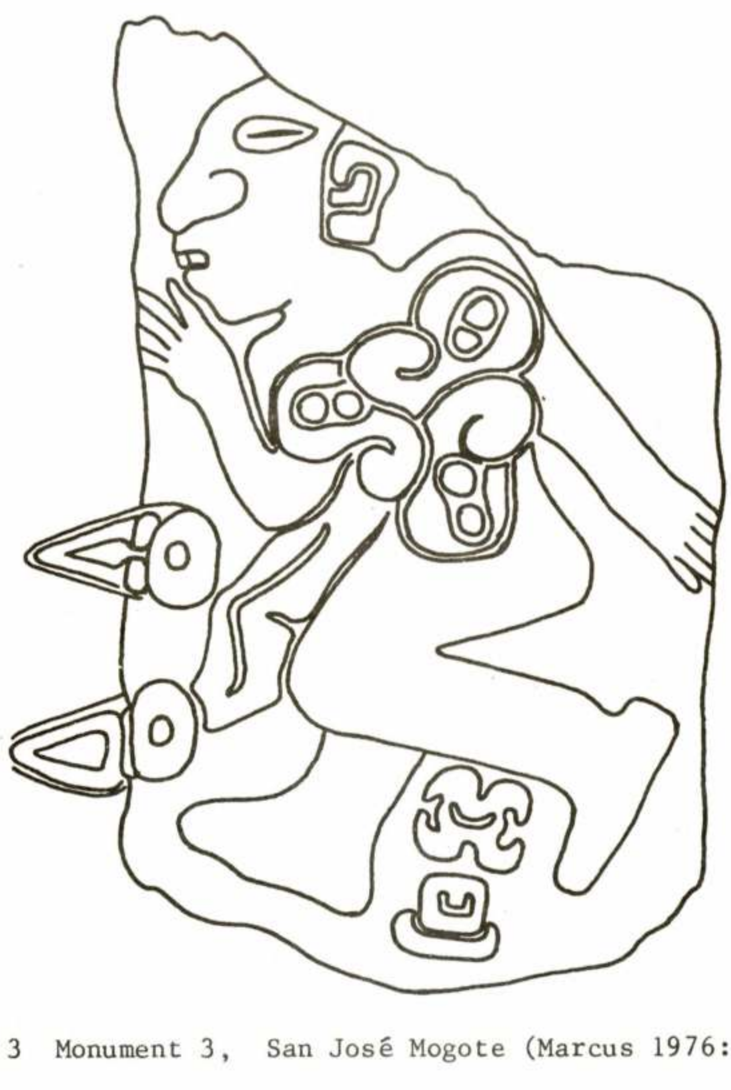


Fig. 3 Monument 3, San José Mogote (Marcus 1976: Fig.2)

Fig. 2 The divinatory calendar

I Cipactli	1 (1)	8	2	9	3	10	4	11	5	12	6	13	7
II Ehecatl	2	9	3	10	4	11	5	12	6	13	7	1 (18)	8
III Calli	3	10	4	11	5	12	6	13	7	1 (15)	8	2	9
IV Cuetzpalin	4	11	5	12	6	13	7	1 (12)	8	2	9	3	10
V Coatl	5	12	6	13	7	1 (9)	8	2	9	3	10	4	11
VI Miquiztli	6	13	7	1 (6)	8	2	9	3	10	4	11	5	12
VII Mazatl	7	1 (3)	8	2	9	3	10	4	11	5	12	6	13
VIII Tochtli	8	2	9	3	10	4	11	5	12	6	13	7	1 (20)
IX Atl	9	3	10	4	11	5	12	6	13	7	1 (17)	8	2
X Itzcuintli	10	4	11	5	12	6	13	7	1 (14)	8	2	9	3
XI Ozomatli	11	5	12	6	13	7	1 (11)	8	2	9	3	10	4
XII Malinalli	12	6	13	7	1 (8)	8	2	9	3	10	4	11	5
XIII Acatl	13	7	1 (5)	8	2	9	3	10	4	11	5	12	6
XIV Ocelotl	1 (2)	8	2	9	3	10	4	11	5	12	6	13	7
XV Cuauhtli	2	9	3	10	4	11	5	12	6	13	7	1 (19)	8
XVI Cozcacuauhtli	3	10	4	11	5	12	6	13	7	1 (16)	8	2	9
XVII Olin	4	11	5	12	6	13	7	1 (13)	8	2	9	3	10
XVIII Tecpatl	5	12	6	13	7	1 (10)	8	2	9	3	10	4	11
XIX Quiahuitl	6	13	7	1 (7)	8	2	9	3	10	4	11	5	12
XX Xochitl	7	1 (4)	8	2	9	3	10	4	11	5	12	6	13

The numbers in columns combine with each day-name to label the days. The numbers within circles indicate the number of each trecena in the 260-day cycle.

or (c) on the last day of the nemontemi.

Because of the five extra days the day-name labelling a given year will always be situated 5 positions further than the one naming the previous year. This results in four possible year-names combined with the entire sequence of numbers 1 to 13-- a set of 52 combinations all told. Day-names in their function as year-names are referred to (with and without accompanying numerals) as year-bearers. In the majority of Mesoamerican calendars the year-bearers fall in positions 3 (Calli), 8 (Tochtli), 13 (Acatl) and 18 (Tecpatl) of the day-name series, alternatives one position up or down occurring in certain areas or in certain periods.

The Calendar of the Preclassic

For the first conclusive examples of the use of the 260-day calendar we must turn to the Valley of Oaxaca, to the sites of San José Mogote and Monte Alban. A carved stone slab excavated at San José a few years ago has been proclaimed as the first documented use of the calendar, dating to the Middle Preclassic, c. 600 B.C. (Marcus 1976: 44-45). Between the feet of a figure resembling the so-called danzantes of preclassic Monte Alban appears a date read by Marcus as "1 Earthquake" (Fig. 3).

If taken alone, the style of the calendar hieroglyphs below the San José danzante would suggest a date no earlier than the Proto-Classic, beginning around 200 A.D. with the First Intermediate Period (Transición II-IIIA) and Monte Alban Period IIIA (c. 250-450 A.D.). The sign for the numeral 1 is embellished with a curved base and the U-bracket, a hallmark of the Classic unattested in earlier periods. Furthermore, the day-sign identified by Marcus as the 17th Zapotec day-name "Earthquake" takes a form here which is not attested before the Monte Alban Classic. In fact, a virtual duplicate is found on the stone marker excavated in the Zapotec quarter of Teotihuacan, which is some thousand years later than the date Marcus assigns to the San José slab, coming as it does from Monte Alban IIIB (c. 450-700 A.D.).

Caution is, moreover, advisable in accepting Marcus' translation of the 16th-century Zapotec day-name Xoo "Fury, Violence, Turbulence" as "Earthquake", which is only one of the extended meanings of the word (it is, for example, used also in connection with storms). Marcus' translation, influenced understandably by the frequent seismological association of the equivalent day, and related sign, in other Mesoamerican calendars, is brought into question by the early iconographic use of the day-sign to represent falling water, a torrential downpour, or the like. The essentially aqueous nature of this sign is further attested on a Classic Veracruz figurine and in a mural on House E at Palenque, where it is rendered in blue with attendant drop elements (cf. Seler 1915: 428, 482-86).

Since officials of the Mexican Instituto Nacional de Antropología e Historia have informed me of some uncertainties

regarding the exact chronological context of the stone slab as excavated by Flannery and Marcus, it would seem best to withhold final judgement on the matter until such questions are resolved. Nevertheless, given the fact that we are dealing with glyphs on a danzante-style monument, I would argue, albeit tentatively, for a terminal Late Preclassic date.

With Monte Alban I (c. 500-200 B.C.) the first indisputable evidence for the Zapotec, and Mesoamerican, calendar comes to light in the form of five inscribed stelae at Monte Alban. Situated alongside the earliest level of the Danzante wall (Caso 1947), these monuments are assigned to the middle of the period (Scott 1978: 15, 42, 68-71). With the exception of stelae 14 all record dates in the divinatory calendar, Stelae 12, 13, and 17 (Fig. 4) providing at the same time evidence for the solar calendar.

Alfonso Caso, whose incisive studies of the hieroglyphics of Monte Alban (1928; 1947; 1965) laid the groundwork for research on the devlopment of the Zapotec calendrical system, was confronted here with the major problem of differentiating between the various kinds of calendrical sign one might expect to be represented in a Mesoamerican writing system. Foremost was the task of separating day-signs from signs for larger units such as years, months and four- or five-part divisions of the divinatory calendar.

The Year-bearers

With the archaic texts of Stelae 12 and 13, plus the much later stelae of Classic Monte Alban at his disposal, Caso set about determining the value of an important glyph which he called the "head of Cocijo" (the god of rain and lightning; see Fig. 5) or, more accurately, "headdress of Cocijo" (Caso 1928: 45-49; 1947: 28-29). Noting that one set of glyphs always occurs with numerals, and that the number is never higher than 13, Caso concluded that the signs in question must be day-names. Since a bare handful of such signs also appeared below the headdress element of Caso's "head of Cocijo", usually at the beginning of a column, he had little hesitation in identifying these as year-signs (1928: 45-59).

Unable to match up the Zapotec year-bearers with the Mixtec and Aztec series (Calli/House, Tochtli/Rabbit, Acatl/Reed, Tecpatl/Flint), Caso was drawn to an alignment one series higher (Ehecatl/Wind, Mazatl/Deer, Malinalli/Twisted Grass, Olin/Movement) by his recognition of an apparent deer's head occurring with the year-sign on Classic Period monuments (1928: 54), and by the existence of such a series among the Postclassic Cuicatec and, alledgedly, Classic Maya.

This deer glyph (Caso's Glyph G) is, however, two signs, consisting of the heads of a deer and of a rabbit or hare. Both share a lolling tongue, which Caso took to be the hallmark of the deer alone, whereas in fact the latter's antlers might be taken as a better diagnostic feature-- at least as far as Zapotec inscriptions are concerned.

Stela 12

Stela 13

Stela 15

Stela 17

Fig. 4 The Stelae of Monte Alban I (Caso 1947: Figs. 10, 11, 14, 15)

Fig. 5 Year-glyph (upturned), Stela 3 (after Caso 1928: Fig. 31)

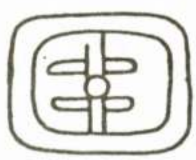
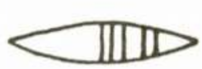
Period	Acatl	Tecpatl	Calli	Tochtli
I				unattested
II				
III				
IV	↓	↓	↓	↓

Fig. 6 The Year bearers

The Monte Alban year-bearers were identified by Caso as Turquoise (or Jade), Deer, Serpent (or Serpent Mask), and Bat (1947: 29). Of these the first and last are unknown on other Mesoamerican calendars. The second and third, on the other hand, are found on almost all day-name lists since they are situated a mere two positions apart. Even reinterpreting Deer as Rabbit will not solve the problem, since these are still only three positions apart, instead of the required five.

In 1976 at the Annual Meeting of the Society for American Archaeology I presented a means of bringing the Monte Alban evidence into an acceptable Mesoamerican pattern. As I have discussed elsewhere (1980: 26-36; 1981; 1983), a comparison of Zapotec inscriptions from different time-depths will show that the symbols employed to name the days in their function as year-bearers were actually subject to change from period to period (Fig. 6). Not four, but eight, different signs are recorded attached to Caso's year-glyph, and among these are the three labelled Turquoise, Deer and Serpent. I am at some odds to explain the absence of a year Bat, but a careful study of all published and unpublished inscriptions at Monte Alban has forced me to the conclusion that no sign depicting this or anything similar is attested from any period at the site.

From Period 1 Stelae 12, 13 and 17 we may extract three of the four Monte Alban year-bearers, which take the form of a dragon's head, a crosspiece device and a jaguar's head (the latter regarded by Marcus, 1976: 46, as a month name). The first is Caso's "head of Cocijo" and year Serpent or Serpent mask combined. If we compare the sign in Figure 5 with the year-name on Stela 12, we find that in both cases the dragon-like head should be considered not a part of the year glyph, but rather a quite separate year-name, and that the headdress alone functions as a sign for year. Neither a year Serpent nor a year Dragon will, however, match up in compatible positions with a year Jaguar.

A comparison of the Period I year-bearers with those of Period III, as found on the stone cover of Tomb 104, provides the solution: of the years named in sequence, the second and third are depicted by a flint knife and house-- matching the Classic Maya (cf. Thompson 1960: 124), Mixtec and Aztec year-bearers Tecpatl and Calli-- and, therefore, the first and fourth, in the form of Caso's Serpent Mask and Turquoise, must be equivalent to Acatl and Tecpatl. The "turquoise" glyph, which I prefer to call "swirling bands" on formal grounds, may be compared with the Maya Lamat (=Tochtli), which is similarly divided into four chambers. By further comparison with later inscriptions, the crosspiece and jaguar of Period I may be lined up with the Flint and House of Period III (Whittaker 1980: 33-34). In these early cases we are dealing with symbolical associations of the day-names in their special role as year-bearers.

The *Trecena* Cycles

A calendrical sign which appears only once at Monte Alban, on

Stela 17 of Period I (see Fig. 4), supplies a vital clue in ascertaining the exact position of the year-bearer in the Zapotec calendar. In the upper right-hand column below the date 2 Ozomatli or Monkey (with fingers standing for the digits) is a long cigar-like sign followed by the number 18. Caso has suggested (1947: 10-11) that this may be the name of a month in which 2 Ozomatli is the eighteenth day, a hypothesis which can be tested now that the year dates are identifiable.

If the year-bearer 12 Tecpatl fell on the first day, all months of that year would have begun with a day Tecpatl, and 2 Ozomatli would have been the 14th day of Month 7. If the year-bearer fell on the 360th day, the date would have been the 13th of Month 12. A year which had 12 Tecpatl as its 365th day would, however, yield for 2 Ozomatli a position 18 in Month 12.

The matter would seem to be resolved by this close match, but there are reasons for finding this solution less than satisfactory. Firstly, there is one other time division which meets the necessary requirements: the 13-day period. If the year-bearer fell on the 360th day, instead of the 365th, 2 Ozomatli would then have occurred in position 12 of the 18th 13-day period counting from 4 Quiahuitl, the first day of the year (Fig. 7).

Locating the year-bearer on the 360th day of the year would accord best with the evidence available to us for the Mixtec and Aztec calendars, which stand in a direct line of descent from the calendar of Monte Alban. It is also reasonable to expect that a Mesoamerican culture would avoid placing the year-bearer within the five ill-fated days at the end of the year, and that the first day, as under the Classic Maya, and last day of the solar month cycle, as under the Aztecs, would have been considered rather more appropriate.

Further light may be shed on this problem by another period glyph, Caso's Glyph W (catalogued W(hittaker) 542-545); see Fig. 8), which in contrast to the first glyph (W864) is of frequent occurrence in periods I and II. This sign has been variously analysed as a day-name (Caso 1928: 44, 95), a month-name (Caso 1947: 29; Marcus 1976: 46-47), due to the discovery of texts where it is followed by numbers above 13, and as a count of elapsed time (Prem 1971: 120-21). An examination of the context of this sign has led me, however, to the conclusion that it stands for the ritual semilunation known as the <u>trecena</u> (Whittaker 1980: 36-37; 1981; 1983), and takes in fact the form of a conventionalised half-moon. The number following the sign places a named day in an elapsing trecena of that number in the divinatory calendar. Unlike the Maya who recorded month dates as elapsed time, the Zapotecs recorded dates in elapsing time, a distinction of some importance to the decipherer (cf. Córdova 1886: 155ff. for the 16th-century Zapotec modes of counting time). By means of the trecena device it is possible to anchor a number of day-signs to their corresponding positions on the day-name list. Thus, Stela 15 places a day 1 Xochitl (Zapotec <u>Loo</u> "Face") in Trecena 4, while Stela 15 records 2 Ozomatli in Trecena 14.

I Cipactli	1 (1)	8	2	9	3	10	4	11	5	12	6	13	7	1 (1)	8	2	9	3	10	4	11	5	12	6	13	7	1 (1)	8	2	9	3	10
II Ehecatl	2	9	3	10	4	11	5	12	6	13	7	1 (18)	8	2	9	3	10	4	11	5	12	6	13	7	1 (18)	8	2	9	3	10	4	11
III Calli	3	10	4	11	5	12	6	13	7	1 (15)	8	2	9	3	10	4	11	5	12	6	13	7	1 (15)	8	2	9	3	10	4	11	5	12
IV Cuetzpalin	4	11	5	12	6	13	7	1 (12)	8	2	9	3	10	4	11	5	12	6	13	7	1 (12)	8	2	9	3	10	4	11	5	12	6	13
V Coatl	5	12	6	13	7	1 (9)	8	2	9	3	10	4	11	5	12	6	13	7	1 (9)	8	2	9	3	10	4	11	5	12	6	13	7	1 (9)
VI Miquiztli	6	13	7	1 (6)	8	2	9	3	10	4	11	5	12	6	13	7	1 (6)	8	2	9	3	10	4	11	5	12	6	13	7	1 (6)	8	2
VII Mazatl	7	1 (3)	8	2	9	3	10	4	11	5	12	6	13	7	1 (3)	8	2	9	3	10	4	11	5	12	6	13	7	1 (3)	8	2	9	3
VIII Tochtli	8	2	9	3	10	4	11	5	12	6	13	7	1 (20)	8	2	9	3	10	4	11	5	12	6	13	7	1 (20)	8	2	9	3	10	4
IX Atl	9	3	10	4	11	5	12	6	13	7	1 (17)	8	2	9	3	10	4	11	5	12	6	13	7	1 (17)	8	2	9	3	10	4	11	5
X Itzcuintli	10	4	11	5	12	6	13	7	1 (14)	8	2	9	3	10	4	11	5	12	6	13	7	1 (14)	8	2	9	3	10	4	11	5	12	6
XI Ozomatli	11	5	12	6	13	7	1 (11)	8	2	9	3	10	4	11	5	12	6	13	7	1 (11)	8	2	9	3	10	4	11	5	12	6	13	7
XII Malinalli	12	6	13	7	1 (8)	8	2	9	3	10	4	11	5	12	6	13	7	1 (8)	8	2	9	3	10	4	11	5	12	6	13	7	1 (8)	8
XIII Acatl	13	7	1 (5)	8	2	9	3	10	4	11	5	12	6	13	7	1 (5)	8	2	9	3	10	4	11	5	12	6	13	7	1 (5)	8	2	9
XIV Ocelotl	1 (2)	8	2	9	3	10	4	11	5	12	6	13	7	1 (2)	8	2	9	3	10	4	11	5	12	6	13	7	1 (2)	8	2	9	3	10
XV Cuauhtli	2	9	3	10	4	11	5	12	6	13	7	1 (19)	8	2	9	3	10	4	11	5	12	6	13	7	1 (19)	8	2	9	3	10	4	11
XVI Cozcacuauhtli	3	10	4	11	5	12	6	13	7	1 (16)	8	2	9	3	10	4	11	5	12	6	13	7	1 (16)	8	2	9	3	10	4	11	5	12
XVII Olin	4	11	5	12	6	13	7	1 (13)	8	2	9	3	10	4	11	5	12	6	13	7	1 (13)	8	2	9	3	10	4	11	5	12	6	13
XVIII Tecpatl	5	12	6	13	7	1 (10)	8	2	9	3	10	4	11	5	12	6	13	7	1 (10)	8	2	9	3	10	4	11	5	12	6	13	7	1 (10)
XIX Quiahuitl	6	13	7	1 (7)	8	2	9	3	10	4	11	5	12	6	13	7	1 (7)	8	2	9	3	10	4	11	5	12	6	13	7	1 (7)	8	2
XX Xochitl	7	1 (4)	8	2	9	3	10	4	11	5	12	6	13	7	1 (4)	8	2	9	3	10	4	11	5	12	6	13	7	1 (4)	8	2	9	3

Fig. 7 Solar trecenas of the year 12 Tecpatl. Divinatory trecenas are numbered in small circles. The beginnings of solar trecenas are marked with an X. Dates recorded on Stela 17 are within large circles.

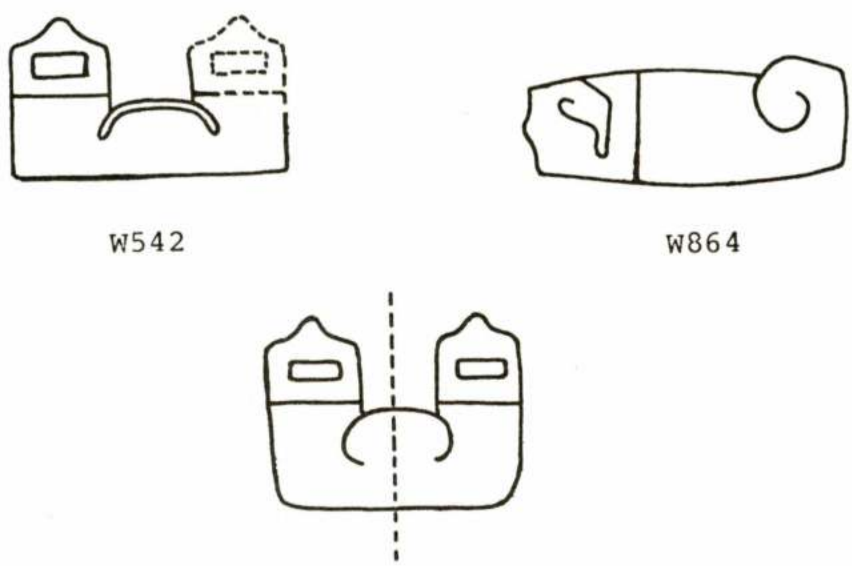


Fig. 8 The trecena glyphs

A comparison of the two period signs of Monte Alban I reveals a certain formal resemblance between them, which strongly suggests the derivation of the first from the trecena glyph. Since the latter depicts a half-moon, a related meaning must be sought for the derivative. "Month" would again seem a logical choice, but this presents difficulties. A reading 2 Ozomatli, Month 18 will not fit any placement of the year-bearer, the only acceptable readings in this case being Month 7 or Month 12.

The possibility that the sign in question is the name of one particular month, and that 18 is the position of the day within this (12th) month, may be ruled out by virtue of the fact that such a sign would not simply be a derivative of the sign for half-moon, but would have to have graphic characteristics distinguishing it unmistakenly from seventeen other signs in this category. An examination of the glyphs for the Classic Maya month names will illustrate this point.

The Novena Cycle

Indirect evidence for the year-bearer on the 360th day, and therefore support for the identification of the mystery glyph as that for "solar trecena", comes from Tablet 14 of Period II (c. 200 B.C. - 250 A.D.). This inscription (Fig. 9), the longest known to us from Monte Alban, records dates anchored in four trecenas. The central column-- and main text-- beginning with the name of the year, 6 Tochtli, refers to the subjugation of a town on the day 11 Calli (Whittaker 1980: 37-39, 134-36; 1982). The first column (from the right) is a preface which reads: "Trecena 5 (named) Reed descends to 7 Quiahuitl". The primary date 11 Calli occurs four days later, still within the 5th trecena, which began with 1 Acatl (Reed). In the upper left of the tablet is a colophon of reduced-size hieroglyphs. This two-column text contains four dates: on the right a probable day 8 Olin and below it a damaged 5 Mazatl or 6 Tochtli (the year-bearer) in Trecena 15; and on the left, in a most unusual mirror-image sequence: Trecena 4, 2 Cipactli; 10 Calli, Trecena 2.

The dates 11 Calli and 6 Tochtli require no further comment, but the other dates present a curious pattern. In the divinatory calendar 10 Calli, 2 Cipactli, and 7 Quiahuitl are separated from each other by 9-day intervals, and 8 Olin falls on day 9 of the last month of the year. The preface and colophon, therefore, seem to be concerned with placing the subjugation of the town not simply in the ritual context of the 13-day trecenas, but rather in that of the very important Mesoamerican series known as the Lords of the Night.

Of relevance here is the coupling of dates in the far left column with deity heads identifiable from comparative Mesoamerican iconography. Above the date Trecena 4, 2 Cipactli appears the head of a god known conveniently by the Aztec label Xipe, who is lord over the 4th trecena, which begins with 1 Xochitl, the Zapotec sign for which is the face of Xipe.

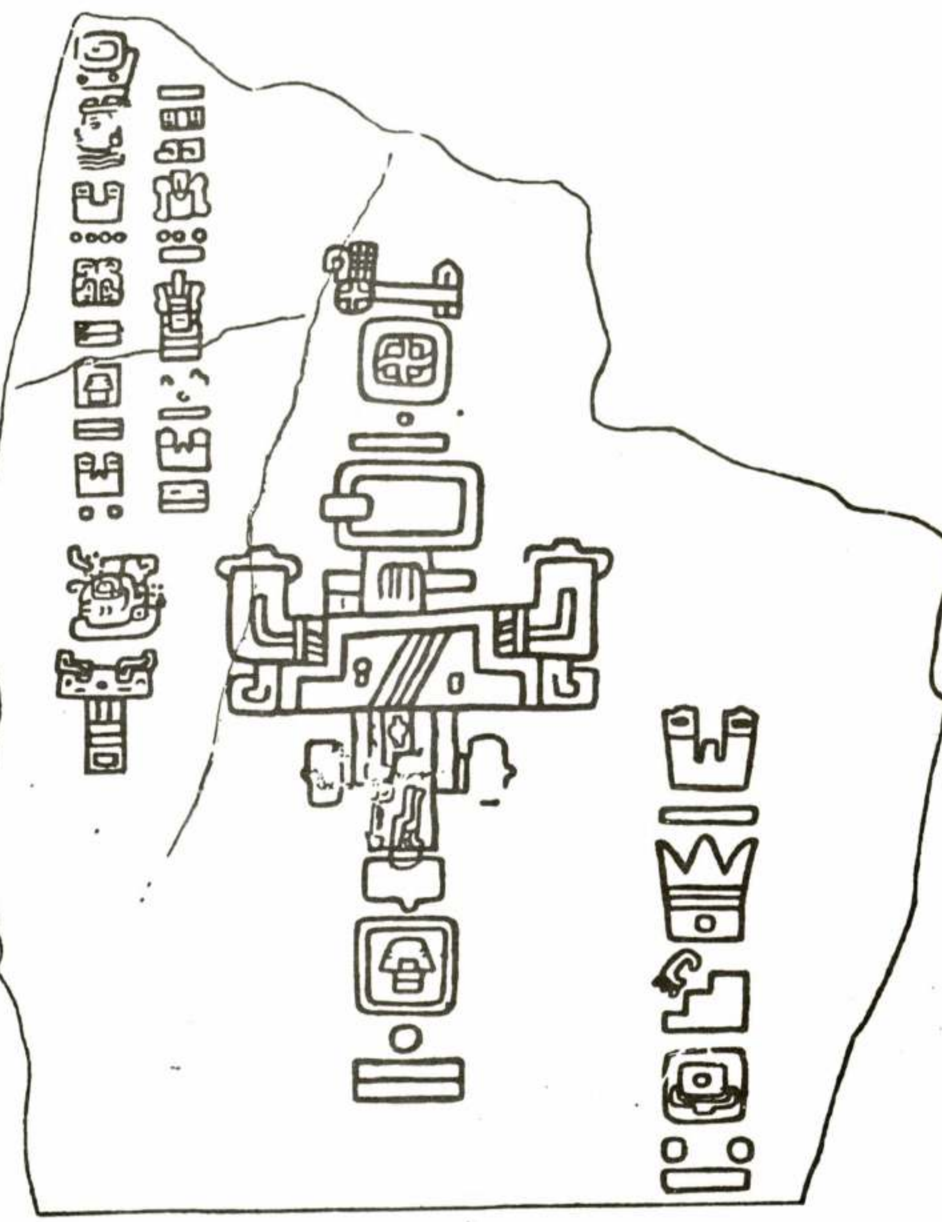


Fig. 9 Tablet 14 (after Caso 1947: Fig. 44, with corrected Trecena 15)

I Cipactli	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10
II Ehecatl	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11
III Calli	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12
IV Cuetzpalin	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13
V Coatl	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1
VI Miquiztli	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2
VII Mazatl	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3
VIII Tochtli	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4
IX Atl	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5
X Itzcuintli	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6
XI Ozomatli	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7
XII Malinalli	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8
XIII Acatl	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9
XIV Ocelotl	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10
XV Cuauhtli	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11
XVI Cozcacuauhtli	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12
XVII Olin	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13
XVIII Tecpatl	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1
XIX Quiahuitl	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2
XX Xochitl	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3

Fig. 10 Novenas of the year 6 Tochtli. Divinatory trecenas are numbered in small circles. The beginnings of novenas are marked with an X, and year dates 5 Calli and 6 Tochtli with a +. Dates recorded on Tablets 10 and 14 are within large circles.

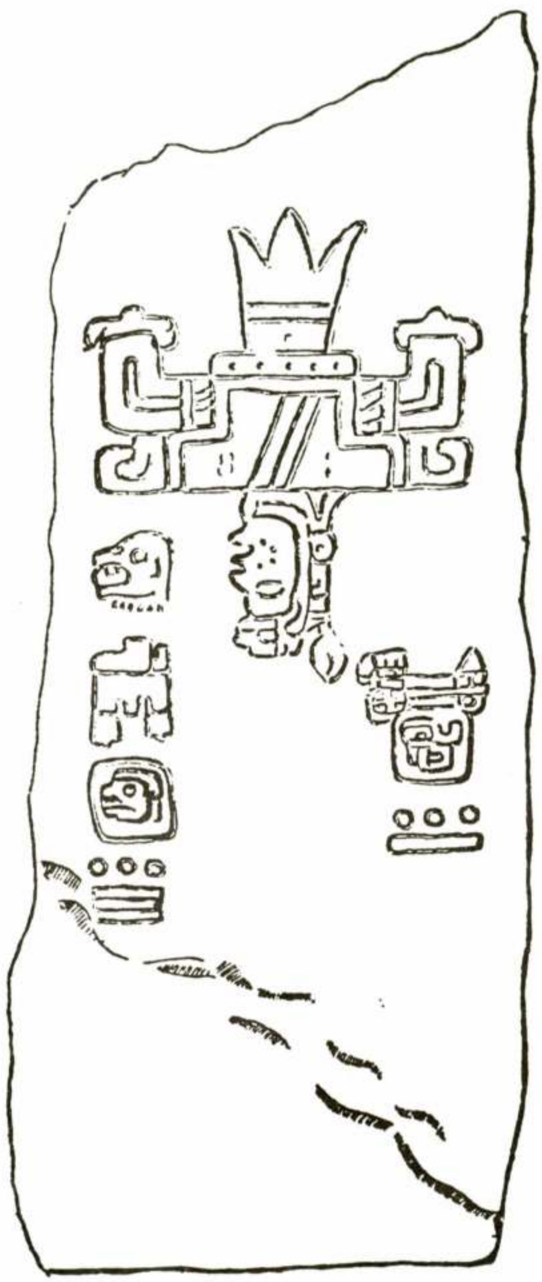


Fig. 11 Tablet 16 (Caso 1947: Fig. 45)

Similarly, below the date 10 Calli, Trecena 2 we find the head of a god who has affinities with the Aztec Tezcatlipoca Tepeyollotl, a jaguar deity dominating the 2nd trecena, which begins with 1 Ocelotl (Jaguar). Over Xipe's head is a vessel of water, his symbol as god of the dew known to the Aztecs as the Night Drinker. Under the Tezcatlipoca aspect is a flaming torch, symbol of this god known as the Night, the Wind.

If the solar year were divided in early Zapotec times into novenas, 9-night periods matching the 13-day periods, I felt it might be possible to map out the placement of these novenas within any given year. A count of novenas tied to the solar year would result in an "empty" (uncounted) day at the end of every second year (or every 729 days, = 9x9x9). This pattern was applied to the year 6 Tochtli of Tablet 14, and the result can be seen in Figure 10. It is significant that the three dates preceding 11 Calli fall on initial nights of three consecutive novenas, and that this is possible only if the year-bearer is situated on the 360th day. The preponderance of night symbolism in this inscription may indicate that the event commemorated was a night action.

A final piece of evidence in support of a Zapotec year-bearer preceding the five empty days at the end of the solar year comes from Tablet 16 (Fig. 11). The left-hand column has a curious characteristic shared by Tablets 12 and 15: an upside-down trecena glyph superfixed with an element resembling feet. Above the compound is the head of a feline, probably a puma, and below it that of a monkey, cartouched and followed by the number 18.

Because the number is too high, the last two glyphs cannot be read together as a day-name and coefficient. Caso (1947: 29) has suggested that the down-turned trecena compound stands for day zero-- the first day of an elapsed-time count-- of his Month W, but this clashes with his interpretation of the number as the position of the day in the month, and of the monkey head as the name of a month (1947: Fig. 66).

If glyph W542 stands for divinatory trecena, as I have argued, two other items must be present: a named day and the number of the trecena to which it belongs. Since 18 cannot be the coefficient of a day-name, it must be the number of the trecena, in which case the intervening monkey head is unlikely to be a day-name. On Tablet 14, as we have seen, one trecena glyph is followed first by its number (5) and then by its name ([1] Acatl).

On Tablet 16 this practice seems to be reversed, but Trecena 18 should commence with and be named Ehecatl (general Mesoamerican "Wind", but Zapotec Quij "Fire"), not Ozomatli, or Monkey, as found here. The analogy of the year-bearers, where alternate symbols may be substituted for the standard signs, may have some bearing on the problem. Since the numerical context is sufficient to prevent confusion, the expected flaming torch for Fire/Wind had been replaced by an animal associated with this day-name position-- in Aztec times the monkey is a primary aspect of the wind god, who is also god of the day Ehecatl.

The position of the day within Trecena 18 remains to be determined. A day zero as initial day must be rejected on the weight of the evidence from Stela 13, where the first day of Trecena 4 is written with a finger for the number 1 and the trecena glyph is upright. The alternative is to take the down-turned trecena glyph as signifying the end of a trecena or, together with the superfix, "at the foot of the (descending) trecena". The numeral 13, which can occur only with the final day-name of a trecena, is attested only once in this context on existing monuments of Preclassical Monte Alban, and thus there is no barrier to such an interpretation on the grounds of graphic convention. Interestingly, the only other numeral virtually absent from the corpus is 9, a reflection perhaps of its portentous nature.

If, then, the day recorded is the final day of Trecena 18, the day-name alone would suffice to complete the required format. This should be, as a glance at Figure 2 will demonstrate, a day 13 Ocelotl/Jaguar in the general Mesoamerican calendar, and above the trecena information on Tablet 16 one indeed finds the head of a feline. This day 13 Ocelotl is, moreover, the first day of the year 8 Acatl named on the tablet, but again only if the year-bearer falls on the 360th day.

The Day-Names

We are now faced with felines occupying two positions in the Zapotec day-name series: Calli (III) and Ocelotl (XIV). While a probable puma head appears alone for the day Ocelotl, the jaguar head alternates with a house glyph as both year- and day-sign for the position Calli in the Monte Alban Preclassic, a fact evident from Tablet 10 (Fig. 12), where the context will permit only a reading 12 Calli, Trecena 8. In the year 6 Tochtli, as recorded on Tablets 10 and 14, the day 12 Calli is the initial day of a no· ena (see Fig. 10) in the first month, and is also within the first full divinatory trecena of the year.

In one instance (Fig. 13) trecena information seems to conflict with the days with which it is associated. 5 Xochitl and 8 Calli are recorded on Tablet 13 in connection with an apparent Trecena 15 (Caso 1947: Fig. 43). A check of the positions of these two days reveals, however, that the trecena in question should be 16 in an elapsing-time system. I have personally examined this inscription and have found that, although this section has undergone considerable erosion, in the space above the three bars of the numeral 15 traces of the missing dot may still be discerned.

Largely as a result of the frequent application of the day-and-trecena formula, it has been possible to identify more than half of the signs representing day-names in the Preclassic, and a few others may be tentatively classified owing to their close resemblance to day-name glyphs of later cultures. The approximate evolution of day-names over the centuries in the Valley of Oaxaca is summarised in Fig. 14. It should be kept in mind that the pre-Conquest "names" provided here are merely convenient labels derived from the form of the hieroglyphs, and are not necessarily identical

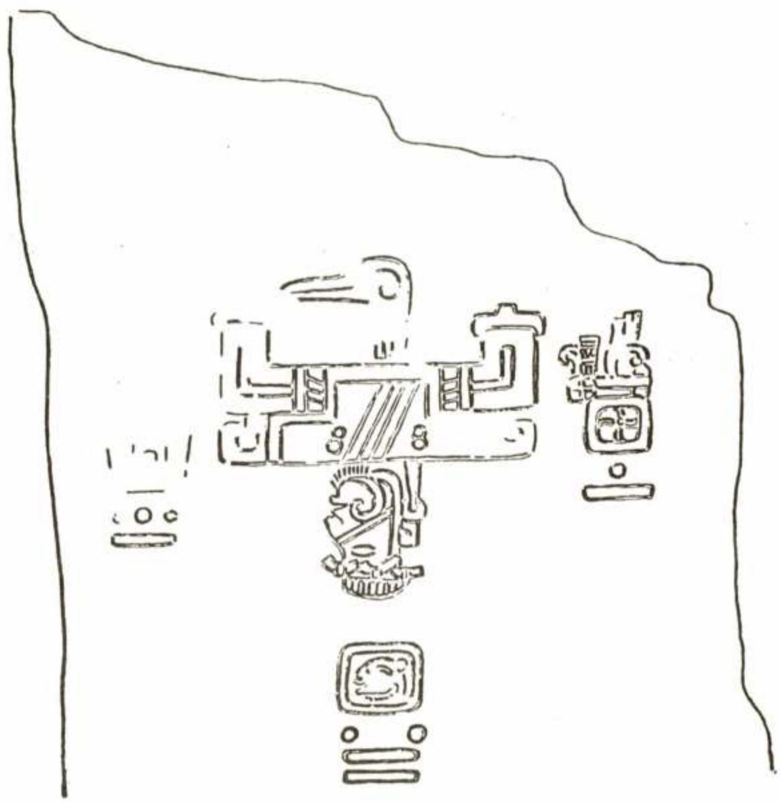


Fig. 12 Tablet 10 (Caso 1947: Fig. 42)

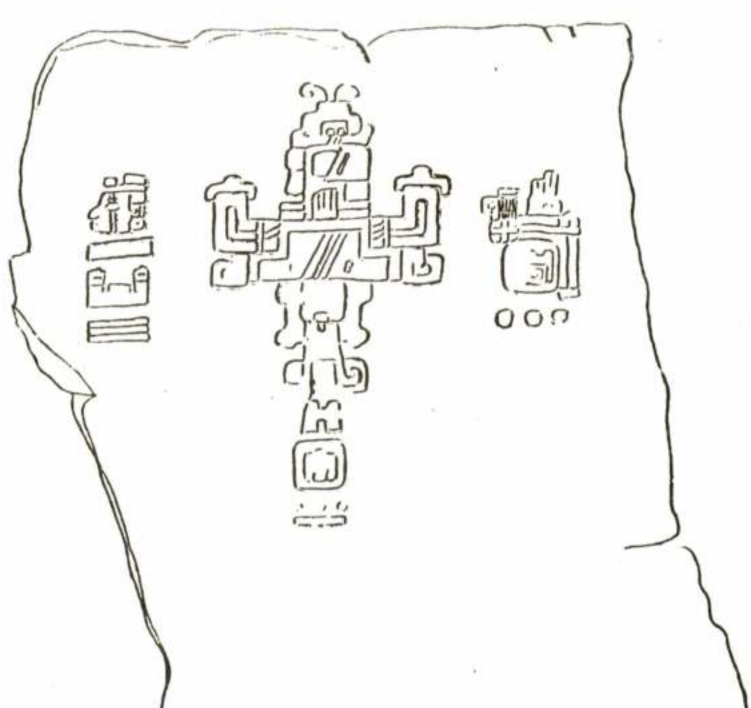


Fig. 13 Tablet 13 (Caso 1947: Fig. 43)

	General Mesoamerican	Preclassic	Classic	Postclassic onwards	
				Name	*Meanings*
I	Dragon	Dragon?	Dragon	*Chilla*	Dragon
II	Wind	Torch	Three-part Scroll	*Quij*	Fire
III	House	House/Jaguar	House	*Quela*	Night
IV	Lizard	-	-	*Queche*	Frog?, Lizard?
V	Serpent	-	Serpent	*Zij*	Misfortune
VI	Death	Death's-head	Death's-head	*Lana*	Gloomy
VII	Deer	-	Deer	*China*	Deer
VIII	Rabbit	Bands	Bands (Rabbit *as year*)	*Lapa*	Fragmented
IX	Water	Water	Water	*Niza*	Water
X	Dog	-	Fire-serpent Tail?	*Tella*	Conflict?
XI	Monkey	Monkey	Monkey	*Loo*	Monkey
XII	Twisted (Grass)	-	-	*Pija*	Twisted
XIII	Reed	Reed (Dragon *as year*)	Cocijo Dragon	*Quij*	Reed
XIV	Jaguar	Puma	Jaguar/Puma	*Queche*	Feline
XV	Eagle	-	-	*(Ñ)aa*	Milpa ?
XVI	Vulture	Owl	Owl/Vulture	*Loo*	Crow
XVII	Movement	Rushing/ Falling Water	Falling Water	*Xoo*	Fury
XVIII	Flint (Knife)	Crosspiece	Flint	*Copa*	Cold
XIX	Rain	Rain	Rain	*Cappe*	Lightning
XX	Flower	(Xipe) Face	(Xipe) Face	*Lao*	Face

Fig.14 Evolution of Zapotec day-"names" (cf. Whittaker 1980: Fig.7)

to the meanings of the actual names used in the periods concerned. There is, of course, no guarantee that day-names were always in the order they take in the Mixtec, Aztec and Yucatec calendars. The original sequence at Monte Alban can be ascertained only by means of a careful search for anchored dates and sequences of days in the inscriptions available to us.

Since the 16th-century Valley Zapotec day-names are neither static in form nor in every case transparent in meaning and unambiguous in spelling, it will continue to be necessary to employ standard Nahuatl terminology, the referents of which are well understood, for Zapotec dates on monuments. Sole use of Spanish or English translations of the Nahuatl terms, while frequent in Mixtec studies, is inadvisable here becauseof the lack of concordance between Zapotec glyph and Nahuatl meaning, which would result, for example, in labelling day-name XX (glyphically a Xipe-like face) Flower.

Developments in the Classic

The inscriptions of Period I constitute related texts in style, format and content, and this holds no less true for the Mound J tablets of earlier Period II. At the beginning of the Classic period, Monte Alban IIIA (c. 250 A.D. - 450 A.D.), a new grouping appears in the form of two related sets of South Platform stelae (Caso 1928; Whittaker 1977; Marcus 1980). Following Preclassic convention, each inscription has a reading order of columns downwards and from right to left when the glyphs face left (standard), and left to right when the glyphs face right. When the columns oppose each other, the right-hand column takes precedence.

A study of the dates on the stelae reveals a remarkable correlation between their sequence in the 52-year cycle and their placement around the South Platform (Fig. 15). The first set, located at both ends of the structure's important north face, follows the sequence (from right to left): Stelae 6 (years 10 Tochtli and 1 Tochtli), 5 (5? Tochtli), 4 (no year), 3 (10 Acatl) and 2 (13 Tochtli). It is no coincidence that the only years found are Tochtli and Acatl years. The vast majority of the post-Period I dated inscriptions at Monte Alban, and for that matter elsewhere in the Zapotec area, record a year Tochtli, and apart from the occasional Acatl, other year positions are virtually unknown. This suggests the possibility that the Zapotecs ordered events to fit the close or beginning of a recurring four-year subcycle, in a kind of ritual systematization of history. Alternatively, it may simply be that they preferred to set down events at four-year intervals.

Be that as it may, the inscriptions of the early Classic have not yet yielded many of their secrets. The familiar trecena glyph of the Preclassic disappears from view, although the signs of the days beginning trecenas are now and then used in its place, an extension of the practice found on Period II Tablets 14 and 16.

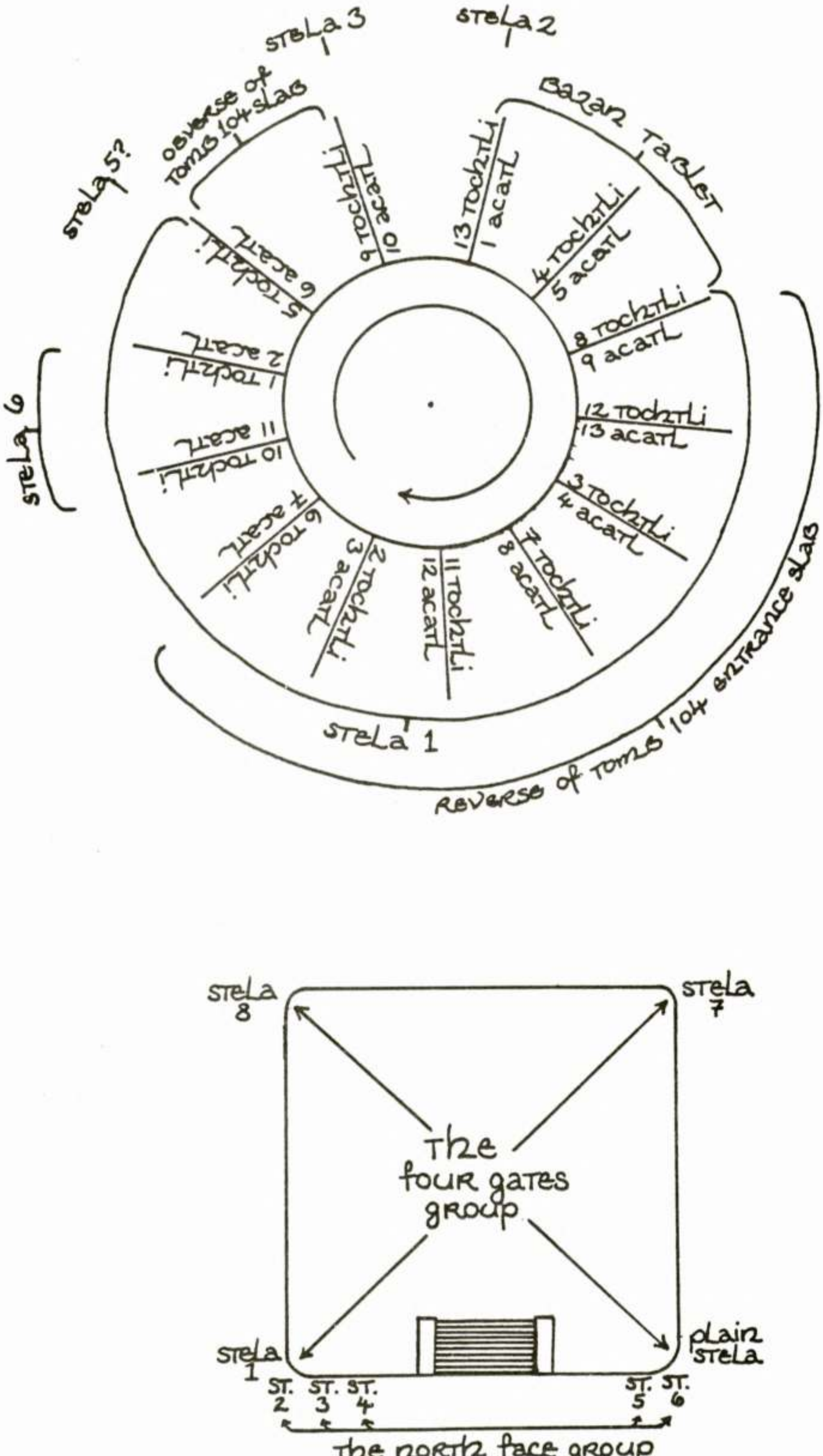
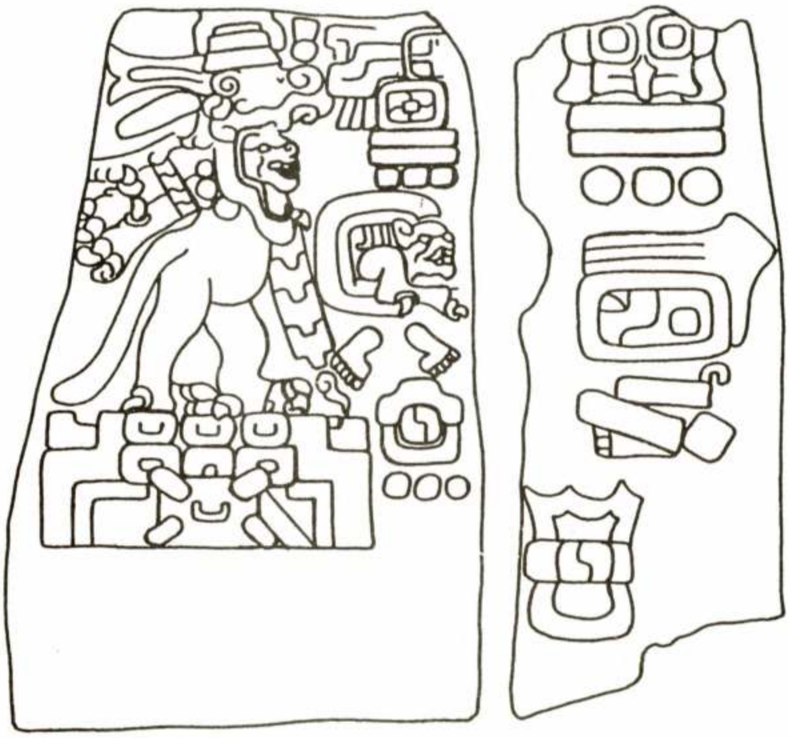
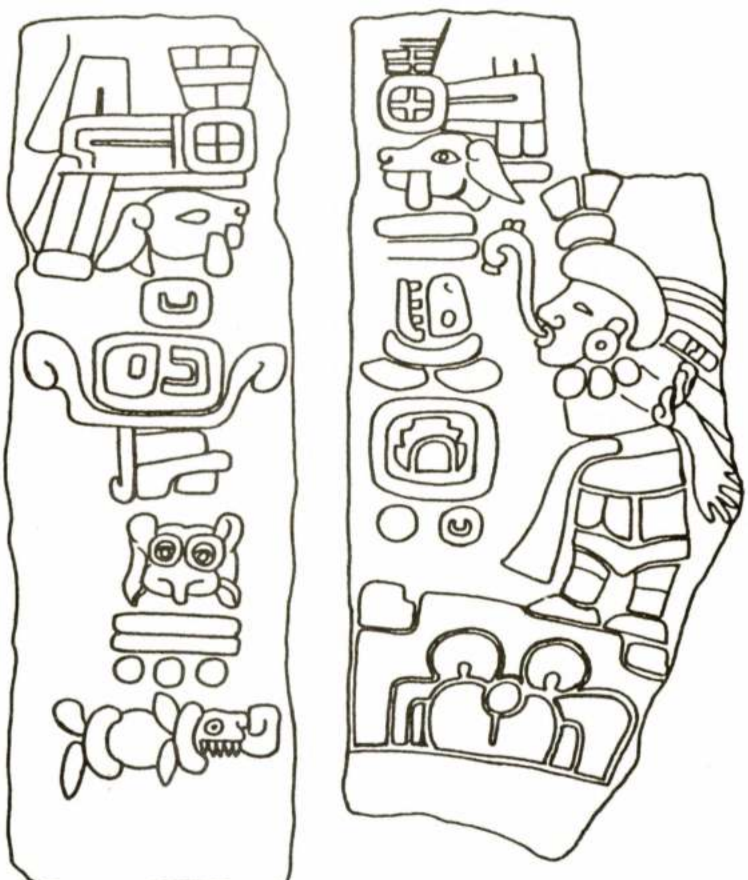


Fig. 15 The chronological and locational order of the South Platform stelae



Stela 2 (front and right side)



Stela 6 (left side and front)

Fig. 16 Corner stelae of the North Face Group (after Caso 1928)

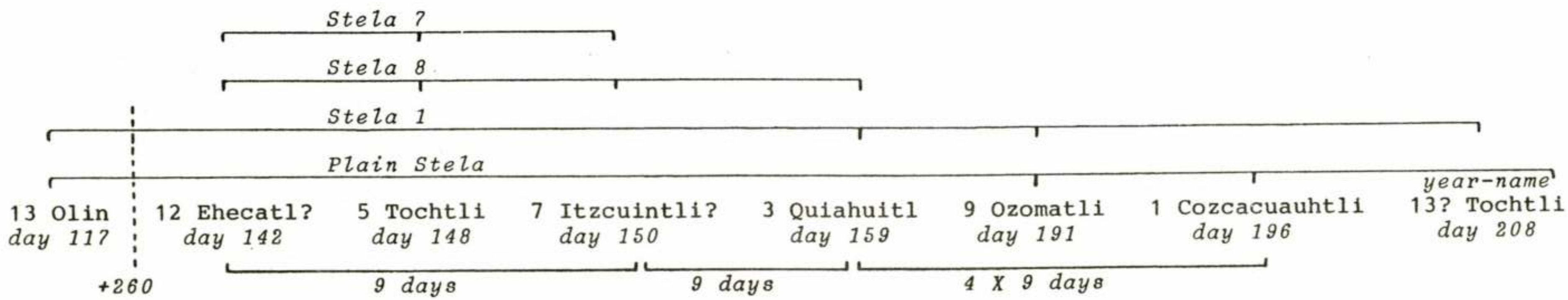


Fig. 17 The date series of the Four Gates Group

A day 13 Cozcacuauhtli (with an owl-like glyph) crops up twice on monuments of the North Face Group, both times in connection with apparent period signs (Fig. 16). At the extreme northwest corner, on Stela 6, it occurs below a cartouched element which rests in a basin over the lower half of a human body in the cross-legged seating position. In the northeast corner, on Stela 2, the date precedes a cartouched glyph surmounted by a hand and subfixed by the same seating element as on Stela 6. Since the cartouched elements do not appear as day-signs elsewhere at Monte Alban, there is a strong possibility that we are dealing with a larger unit - a month or one of the 52- or 65-day periods within the divinatory cycle. A month interpretation, however, will not work for the years 1 Tochtli and 13 Tochtli, nor will a 65-day period fit.

Only in the 52-day subdivision of the calendar does 13 Cozcacuauhtli carry significance, as the final day of the third period of the cycle. The context of Stela 6 suggests that the period-sign recorded is that of the third period which is just coming to an end. On Stela 2 a different period-sign follows 13 Cozcacuauhtli, and the hand element is setting it down. The fourth period, which begins here, is ruling when the event of the main text takes place on 3 Quiahuitl, a mere three days after 13 Cozcacuauhtli. On the Mound II Tablet (Caso 1965b: Fig. 17), which bears the same year date as Stela 2, not to mention related iconography, the seated element supports a variant of the Olin sign below a cartouched element which elsewhere seems to mark the commencement of a trecena. The first day of the Olin trecena is, interestingly enough, the first day of the fourth 52-day period.

The second set of Period IIIA stelae (1, 7, 8, and the Plain Stela), which I call the Four Gates Group after one of the traditional names for the South Platform (Whittaker 1980: 166-69), is cast in a style resulting from intensifying foreign contact with the Teotihuacan-dominated North and Southeast. A series of days in the year (13?) Tochtli are named in the order given in Fig. 17. That this was a time of great change is seen in the lack of a single convention for the representation of numerals. On Stela 8 five-bars were placed under the dots as in the Preclassic, on the Plain Stela bars occur both above and below dots, and on Stelae 1 and 7 they appear only above the dots. Numerals may be found without internal detail as on the fronts of Stelae 7 and 8, or embellished as on the sides of these same monuments, where, moreover, a filler element seems to be found in connection with the number 7 (Whittaker 1977; cf. Marcus 1980: 60).

The elements comprising numeral coefficients are as a rule arranged in horizontal layers, these being in all but one instance below the day-names associated. On Stela 1, nonetheless, several coefficients are found standing vertically beside or below the day- or year-name. No difference in function seems to be involved in such cases.

A semblance of order is restored in the 2nd Intermediate Period (or Transición IIIA-IIIB, 5th century A.D.), as exemplified by the reverse of the cover of Tomb 104 (Fig. 18). Again numerals are found both beside and below day-names, but there is a significant

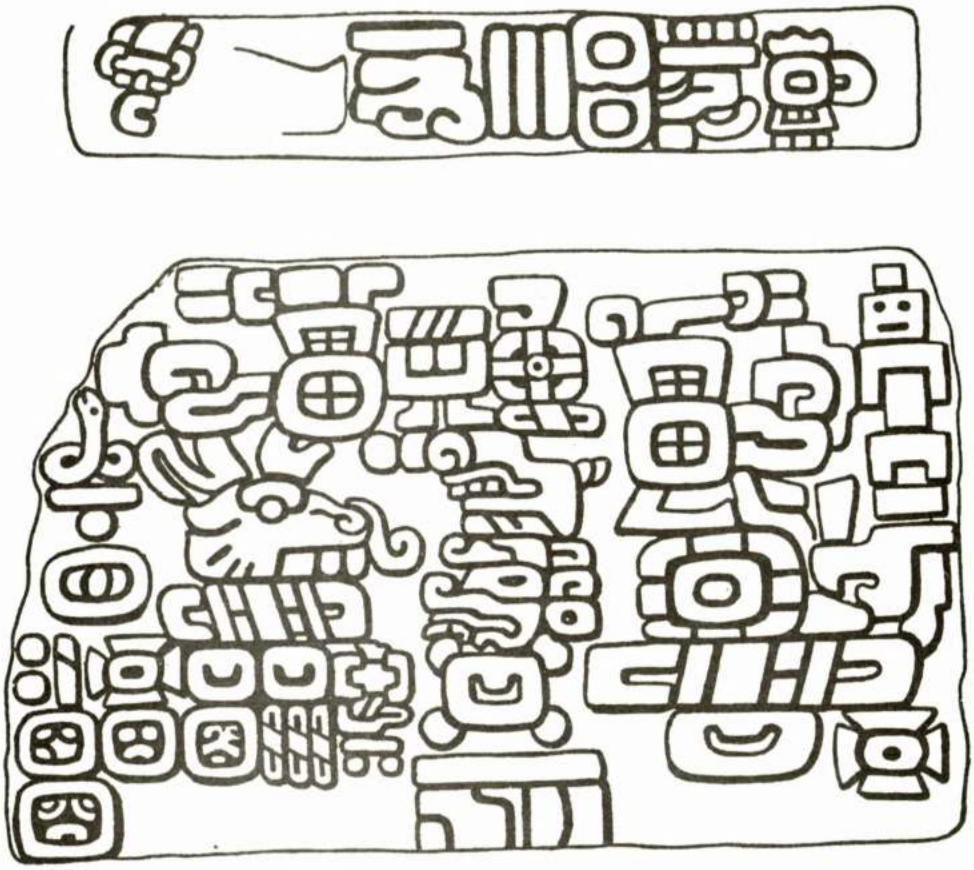
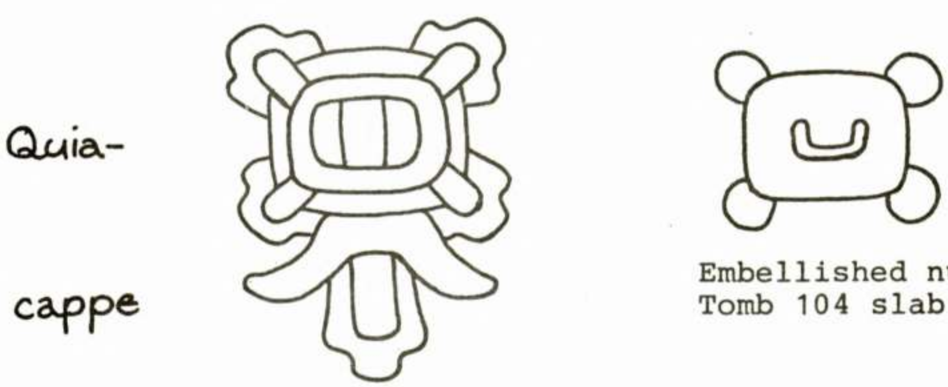


Fig. 18 The reverse of the Tomb 104 entrance slab (after Caso 1938: Fig. 94, with correction of year 9 Acatl on upper edge.



Embellished numeral 1, Tomb 104 slab (reverse)

Calendrical name *Quiacappe*/1 Quiahuitl as Cocijo pendant

Fig. 19 The prefix <u>Quia-</u> as a Classic Period glyph

change in function heralded by the vertically-aligned numerals. In each case where the latter occurs a coefficient is already present in standard horizontal arrangement below the neighbouring day-name, so vertical numerals cannot be day-name coefficients.

In one instance (at lower left) the vertical numeral 7 is followed by a sign which I have identified as the Zapotec equivalent of the Maya kin "sun, day" (Whittaker 1976; 1980: 28, 40-41), which it closely resembles. To their right is the day 7 Mazatl. Since this is seven days after the commencement of the divinatory cycle on 1 Cipactli, the statement "7 days" refers to the position of the primary date in elapsing time.

Below this information is a row of three cartouched glyphs which are followed by a vertical 15 before a day-name with coefficient 7. On its own underneath the first sign is one further cartouched glyph. These four glyphs are the first evidence we have for the Zapotec cocijo or 65-day period, described in Córdova's Arte del idioma zapoteco (1576, 1886). Similar to the signs for 52-day divisions in Monte Alban IIIA-- and possibly adapted from them-- these glyphs stand each for a cocijo of five trecenas, counting forward from a base of 1 Cipactli. The third sign, therefore, should represent Trecenas 11 to 15 inclusive, and the vertical 15 next to it would thus seem to indicate Trecena 15.

The day-sign following takes the form of a cartouched Greek cross above an odd basin-like element, and in the Arrowhead Series at Mound J the emblem of District H, the Mixteca Alta (Mixtec Ñudzahui "Land of Rain"), is a combination of quasi-Greek cross and water/rain elements (Whittaker 1980: 114-15, 133-34). In Trecena 15 the day in question is 7 Atl/Water, the first of the five empty days at the end of the year 6 Tochtli (recorded at the right).

The wide scope of innovation in the artistry of the Early Classic gives way in Period IIIB (c. 450-700 A.D.) to a sharp decline in the sculptural quality and textual coherence of monuments at Monte Alban. Cluttered with crude, ill-proportioned iconography and awkward hieroglyphs, the latter become increasingly difficult to interpret. Stela 9 at the entrance to the North Platform is no exception (see Batres 1902; Caso 1928: Figs. 49-52), although the calendrical information it displays is nonetheless of great importance.

On the north side of the stela two individuals stand above a row of glyphs carrying the message: "3 Cozcacuauhtli, day of capture, Cocijo 1 (?)". At the foot of the monument the inscription concludes: "11 Quiahuitl, day of sacrifice, year 6 Tochtli", below which the glyphs for Cocijos 2, 3 and 4 are given. 3 Cozcacuauhuitli falls in the second trecena of Cocijo 1, 11 Quiahuitl in the 2nd of Cocijo 4. The period glyphs differ somewhat from those found in Monte Alban IIIA and the 2nd Intermediate Period, but a relationship between them seems evident. The glyphs for the 52-day periods apparently were adopted for the later cocijos, the 2nd and 3rd doubling up as alternates for the 3rd cocijo.

The Postclassic and after

With the end of the Classic comes also an end to the last traces of the tradition of writing at Monte Alban. The growth of iconographic and notational systems at the expense of writing is virtually unparalleled in the history of civilisations, but this transformation, all but complete by the mid-1st millennium A.D., gave rise to a versatile new system mixing elements of writing (phonetic renditions of names, creation of verbal glyphs, etc.) in a dominant iconographic structure. Durable stone declined in use as a primary medium of communication, the emphasis passing to a highly perishable medium: paper. Largely for this reason our knowledge of Postclassic calendrics has to rely, not on the sparse and sculpturally poor stone tablets and stelae available from sites around Monte Alban, nor on codices of paper and hide, none of which seems to have survived the Conquest, but on the writings of a Spanish priest of the late 16th century, Fray Juan de Córdova.

In his Arte of 1578 Córdova set down some tantalizingly meager data on the nature of the Valley Zapotec divinatory calendar, including a nonetheless complete transcribed day-count, beginning with 1 Cipactli and divided into trecenas which are in turn grouped into 65-day periods. Each trecena (cocij) and 65-day period (cocijo) bears the name of its first day, continuing a practice going back at least to the Late Preclassic.

A further tradition reflected in hieroglyphic practice is that of placing numerical coefficients after day-names. The Zapotec culture is the only one in Mesoamerica known to have this both hieroglyphically and linguistically as the standard convention. Although the numerals are self-explanatory, the day-names are not. Since Córdova did not think it necessary in his summary to delve into the meaning of the day-names, we are left in a few cases ha ing to hazard a guess where the standard Mesoamerican day-name series or the hieroglyphic record does not provide clues. Tonal and other phonetic features are inadequately and often inconsistently registered in Córdova's work, which only adds to the complexity of the problem. No fully satisfactory interpretations have been given to date for the day-names in positions X (Itzcuintli) and XV (Cuauhtli), and several others have been rather questionably translated by Caso (1947; 1965), where he departed from analyses by Seler (1901; 1904) and Cruz (1935).

As if this were not enough, these difficulties are compounded by the so-called particles prefixed to day-names. Completely lacking parallels in the Aztec and Maya calendars, they evade translation even more than the day-names, for which we at least have equivalents in other parts of Mesoamerica, and documentation in the hieroglyphic script. Interestingly, all Zapotec calendrical names recorded after the Conquest in the Spanish script have these prefixes, but to my knowledge none has the expected numeral coefficient, which is always given on the stone monuments.

This immediately brings to mind the possibility that the prefixes, as I prefer to call them, are remnants of an old number system, but counting against such a hypothesis is their lack of resemblance to any Otomanguean set of numerals, and even if one looks at languages unrelated to Zapotec the prospect seems no brighter. There are, furthermore, not thirteen prefixes as Caso (1965: 944-45) maintains, but nine, of which four repeat at regular intervals.

Leaving aside the occasional irregularity in the day-count sequences, which may result either from slips in transcription or deliberate ritual exceptions, the following pattern emerges:

	+3		+3		
1	Quia-				
2	Pe(la)-	5	Pe(la)-		
3	Peo(la)-			9	Peo(la)-
4	Ca(la)-				
		6	Qua(la)-		
		7	Pil(la)-	10	Pil(la)-
		8	Ne(la)-, La-	11	Ne(la)-, La-
				12	Pino-
				13	Pece-

Of these one is clearly present in the hieroglyphic record as far back as the Protoclassic: the prefix *Quia-*, which occurs with great frequency on urns of the rain god Cocijo ("Thunderbolt"). Effigies of this deity are normally adorned with a pendant bearing his calendrical name 1 Quiahuitl (Zapotec *Quiacappe*, Córdova's *Quegappe*, "1 Flash of Lightning"). The upper element is decorated at its corners with the phonetic symbol *quia/quie*, found among other things in the conventionalized mountain (*quia*) used with place-glyphs, but also used symbolically for rain (*quia*) in the glyph for the day Quiahuitl (see Figure 19).

Wilfrido Cruz, an Isthmus Zapotec, attempted to explain the prefixes as normal Zapotec words in a ritual context (e.g. *peo* as "moon"), and while many of his interpretations (1935) are somewhat less than compelling, his hypothesis does seem on the right track. Particularly astute is his observation that *pece*, which is used only for the final day of a trecena, is the Zapotec word for "portent, omen". It is precisely at this point, at the end of the or overturning of a passage of time, that omens are most expected and feared. I should add that after the Conquest the Devil became associated with the ominous god Bezelao "13 Xochitl", which is the very last day of the divinatory cycle.

The same pattern of prefixes turns up again in day-counts recorded in the northern Zapotec district of Villa Alta in the 16th and 17th centuries (Alcina Franch 1966), and on an unpublished deerskin belonging to the Yale Map Library, which records a genealogy of Zapotec lords up into the 16th century. Informed of the latter's existence by George Kubler, I found it, erroneously catalogued as a "Nauhtl. (sic) deerskin map c.1800?", to be a mine of information on Zapotec calendrical names. Ironically, the sequence of elements in a Zapotec lordly name, as reflected in this document, is the exact opposite of that used by Nahuatl royalty: (1) title, (2) personal name, (3) calendrical name, (4) numeral coefficient.

Since none of the names is rendered in glyphs, the task of analyzing their underlying meaning is all the more difficult. Some calendrical names are nonetheless translatable owing to the fortunate circumstance that neither the prefix nor the day-name is in the Spanish alphabet ambiguous: e.g. Huatela = 6 Itzcuintli, Yaquela = 1 Calli, and Pezechila = 13 Cipactli. Others can be reduced to two possibilities, e.g. Pilahuiya = 7 or 10 Malinalli, while in extreme cases no means of selecting the correct identification is likely ever to become available, e.g. Peloo = 2 or 5 (and perhaps 3 or 9) Ozomatli, Cozcacuauhtli, or Xochitl!

Allowing for the inevitable ambiguities resulting from imprecise phonetic renditions of such names, we are still left at best with dual-referent prefixes, which are less likely to have been differentiated by tone. This brings us again to the problem of their function. Since numbers are dropped in names, the prefixes can be assumed to have taken up the burden they carried, that is, their influence on the fate of the day. A role as fate indicators would explain the disproportionate frequencies of particular prefixes in rulers' names, since we know from Aztec sources that decidedly negative birth dates could be overcome by postponing the naming ceremony, and this would be all the more desirable in the case of future rulers. From a preliminary study of these names I would suggest that 1, 7 and 10 carry a good fate, 3, 9 and 13 a bad one. The relationship between 9 and 13, the numbers appearing with the lowest frequency on pre-Conquest monuments, is evident also in the fact that 9 prefixes were applied to the 13 coefficients at the time of the Conquest. My feeling is that the prefixes are derived from associations with the Zapotec Lords of the Night (see Whittaker 1983).

The symbolism of 9 and 13 crops up again in the present-day calendar of the Southern Zapotecs, which was studied in recent years by Carrasco (1951) and Weitlaner (1958, 1961). There the divinatory calendar of 260 days is made up of 20 trecenas grouped in five 52-day periods, a tradition which may descend from Monte Alban IIIA, before the 65-day period was adopted.

In place of the expected 20 day-names this calendar runs a parallel cycle of novenas, the nine day-names of which follow each other in order except on the first day, on which the initial two novena names double up. This adjustment at the beginning of the

divinatory cycle is somewhat reminiscent of the Preclassic Zapotec novena cycle, which was adjusted to the solar year not by doubling up, but by adding a day at the beginning of every second solar year. In both cases it was the novena cycle which was adjusted in length, not the divinatory or solar cycle.

Despite the many and varied developments in the history of Zapotec culture, it is quite remarkable that the ancient Mesoamerican institution of the calendar has endured so long and remained so conservative. Not even the Southern Zapotec calendar today, for all its losses, has altered its fundamental structure: the divinatory cycle is still 260 days long, still divided into trecenas and subperiods, and still preserves a novena cycle with a doubling-up mechanism known elsewhere in Mesoamerica. Far from being the obscure and seemingly aberrant system it has so long been taken to be, the Zapotec calendar, in all its forms and all its phases, can now be seen to have maintained its basic Mesoamerican character at least 2500 years without major change.

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FRANZ TICHY

Observaciones del sol y calendario agrícola en Mesoamérica

En los altiplanos de México central y de Guatemala así como en la costa del Pacífico reina un clima tropical que varía entre precipitaciones estivales y una temporada seca de invierno. Se cultiva el maíz como un cereal estival en combinación con frijoles, calabazas y otras plantas bajo adecuadas condiciones. Estas se alcanzan solamente en el supuesto de que las lluvias empiecen con puntualidad y son esperadas a fines de abril y primeros días de mayo, pero la incertidumbre amenaza siempre.

El año agrícola y con ello el calendario de trabajo de la población está adaptado en promedio a las condiciones atmosféricas. Hay que insistir en "en promedio", primero a causa de la incertidumbre del comienzo así como también del fin de la temporada de las lluvias, y además porque los fases del tiempo no se pueden esperar en todos los lugares de Mesoamérica en los mismos días o en las mismas semanas. En regiones bajas la situación se presenta en otra forma que en regiones altas, y en otra forma a sotavento que a barlovento, en regiones del Pacífico en otra forma que en las del Atlántico. Así se entiende, la razón por la cual la siembra del maíz se hace en días diferentes adaptándose a las condiciones locales. A pesar de ello se halla una gran coincidencia en los ciclos de trabajo agrícola. Esto es válido sobre todo para los ritos agrícolas en combinación con las costumbres religiosas típicas.

La descripción de la marcha del año agrícola en Tepotzlán/ Morelos, México, es un ejemplo de esta observación hecha por Oscar Lewis (1960). Esta es una región en donde se practica el desmonte con quemadura. En sentido estricto no se trata aquí de un calendario agrícola porque no se mencionan fechas, pero ellas aparecen en las costumbres religiosas. Muy extendido están los ritos agrícolas de la Fiesta de la Sagrada Cruz en los días 1 al 3 de Mayo. En Tepoztlán se celebra la bendición del maíz el día de San Isidro el 15 de mayo. A mediados del agosto se hace una procesión alrededor de los campos, y el 28 de septiembre se ponen cruces en las milpas. En suma, el ciclo de labores puede representarse en forma de calendario agrícola (véase Tabla 1 al final del artículo).

Una estrecha conexión entre el viejo calendario, que aún permanece latente, y el ciclo agrario lo encontró Weitlaner entre los chinantecos en Oaxaca (1969 S.538). El ciclo agrícola está combinado con distintas fechas y además con distintos ritos agrícolas, aún hoy en día en días de Santos o Santas del calendario católico.

Desde siempre se ha necesitado poner la siembra en el momento oportuno para que las primeras lluvias puedan favorecer el desarrollo del cultivo, es decir, no se espera a las lluvias por sembrar después. Pero, ¿cómo fue posible en los tiempos prehispánicos reconocer los distintos días en el curso del año, p.ej. el 1 de mayo de hoy? ¿Cómo fue posible fijar el calendario agrícola y el curso del ciclo de las labores? ¿Cuáles observaciones del sol fueron en última instancia útiles para estos asuntos.

Examinemos primero de todo un ciclo agrícola con fechas conocidas. Se trata de un calendario de 260 días de duración, levantado e interpretado por Rafael Girard en los pueblos chortí en los Altos de Guatemala. El habla del "auténtico tzolkín de los maya" o del "tzolkín original" y escribe en 1982:

"El tzolkín de los chortí se computa desde el 8 de febrero al 24/25 de octubre. Es básicamente un almanaque agrícola ya que su función principal consiste en regular las labores de cultivo, de dos milpas consecutivas al año. Está dividido en dos secciones: una de 80 días que corresponde al período estival y otra de 180 días que es el ciclo de las lluvias... Los chortí cuentan la estación estival del tzolkín por 'cuarentenas' o pares de <u>uinales</u> (véase Tabla 2).

La primera actividad del campesino consiste en la tala de los grandes árboles y debe finalizar en un plazo de veinte días. "Durante el segundo sector de veinte días, el campesino se dedica a la roza de 'montes bajos' o rastrojos." Después del desmonte durante la primera cuarentena se realizan las quemas. Todas las maderas deben estar en iguales condiciones de sequedad. "Las quemas... principian a raíz de los ritos equinocciales en lugares bajos y cálidos y se continúan hasta mediados de abril en tierras altas... La ceremonia de mayor importancia se celebra cuando el sol se realiza su primer paso por el cenit, que los chortí llaman la 'Medianía del Mundo'; ceremonia que dura del 25 de abril al 3 de mayo y determina las primeras lluvias."

El primer paso del sol por el cenit "divide el cuadrante celeste en dos sectores de igual dimensión: el cielo claro y luminoso de la estación estival y el cielo obscuro de 'invierno'... Las dos estaciones del trópico constituyen ciclos temporales perfectamente simétricos de 180 días cada uno y suman el valor de un <u>tun</u> maya de 360 días."

Durante el "reglamento de invierno", que dura 180 días, "el cómputo del tiempo se realiza por novenas y trecenas... Parten dos ciclos de 52 días divididos por el solsticio de verano. Es decir, están enmarcados por los fenómenos más relevantes de la astronomía maya, el primer y el segundo paso del sol por el cenit, divididos exactamente en dos partes iguales por el solsticio. Entre el primero y segundo paso del sol por el cenit se desarrolla todo el ciclo de cultivo de la primera milpa. Entre el primero de estos fenómenos y el solsticio de verano se cuentan cuatro trecenas. Durante la primera se realiza la siembra, en la segunda trecena el

maíz está ya en 'alas de perico', es decir, con dos hojitas, al comenzar la tercera trecena se procede a la primera limpia o deshierbo y al final de la cuarta trecena, realizan los trabajos de la segunda limpia. Durante el primer ciclo de 52 días, el maíz ha llegado a su definitiva caracterización. Desde la quinta trecena, el maíz está 'en elotes', acontecimiento que es celebrado con una fiesta llamada aan kin."

"Los sacerdotes-astrónomos chortí observan el 25 de julio a la Vía Láctea... Notan sus cambios de posición con relación al sol. Para el 25 de julio la trayectoria solar (la eclíptica F.T.) y la Vía Láctea forman una gigantesca cruz en el cielo. Este fenómeno astronómico señala el principio de la canícula, es decir, un período de suspensión temporal de las lluvias y aumento de temperatura, como resultado de las artes mágicas del sacerdote. El Dios de la Vía Láctea se encarga de detener las lluvias durante la canícula para permitir que los campesinos preparen sus tierras de labranza para las siembras llamadas 'de segunda'."

"En la fecha del segundo paso del sol por el cenit del 12 al 13 de agosto, ocurre fuerte precipitación de lluvias de convección... el sacerdote ordena que se realicen las 'siembras de segunda'. Durante el equinoccio del 22 al 23 de septiembre, los campesinos hacen la única limpia de la segunda milpa. Desde el segundo paso del sol por el cenit hasta la ceremonia de clausura del tzolkín, que ocurre a la medianoche entre el 24 y 25 de octubre, median 76 días que corresponden a la segunda siembra y desarrollo del maíz. Al finalizar los 260 días del tzolkín, comienza instantáneamente el culto solar de 100 días que finaliza con los 5 días aciagos, completándose así los 365 días del año maya."

De este modo se presenta la descripción del ciclo agrícola de los chortí por Girard. Pero, ¿qué tan precisa es la relación de los hechos astronómicos con la realidad? La relación existe de hecho para las regiones alrededor de 15 grados de latitud en donde ocurre el primer paso del sol por el cenit al mediodía del 1 de mayo, es decir, dos días después del período de la segunda cuarentena, según Girard. El equinoccio de primavera sucede también el 21 de marzo dos días después del período de la primera cuarentena. El primer ciclo de 52 días finaliza el 19 de junio, dos días antes del solsticio de verano. El segundo paso del sol por el cenit ocurre el 12 de agosto cerca de los 15 grados de latitud norte; el segundo ciclo de 52 días ya finaliza el 10 de agosto. Con el ciclo agrícola según Girard llegamos al fin de los ciclos siempre dos días antes de los fases astronómicos. En su carta del 21 de agosto de este año Girard no puede por el momento explicar bien en que consisten esos dos días de diferencia, sino hasta cuando regresa a Guatemala, para consultar sus informantes, los propios sacerdotes.

Ahora empieza la milpa de segunda con el primer ciclo de 40 días hasta el 19 de septiembre, una fecha elegida de una manera interesante. Este es aquel día que se halla en el punto entre las fechas del solsticio de verano y del solsticio de invierno, se trata de un "día de la mitad del año". Claro que el equinoccio de otoño sigue cuatro días después, el 23 de septiembre. Otros 36

días o 4 novenas siguen y el ciclo finaliza el 25 de octubre.

Siguiendo las fechas levantadas por Girard, pero mejorando su cálculo por un traslado de dos días, el calendario se hubiera organizado de tal manera que pudiera ser controlado a base de observaciones de los pasos del sol por el cenit. Girard no menciona, si la observación es válida para el presente y no podemos esperarla, porque las fechas no corresponden con los límites de los ciclos descritos. La simetría y la coincidencia absolutas existen solamente para un ciclo agrícola que empiece el 10 de febrero y finalice el 27 de octubre. La situación en esta forma vale además solamente para lugares entre la latitud geográfica de 15 grados y la de 14°14'.

En el calendario tzolkín de los chortí son de importancia los equinoccios, pero no es posible verificarlos a través de observaciones relativamente sencillas comparado con el método de los solsticios como puntos extremos del sol en el horizonte. Con una muy grande exactitud, sin embargo, es posible fijar la fecha de un día a través de la observación de los pasos del sol por el cenit, es decir, dos veces al año y solamente en los trópicos. El control de la primera observación, p.ej. el 1 de mayo, es posible, cuando hay sol, bajo 15 grados de latitud norte y el 12 de agosto, 104 días después. Por eso es posible hacer una correlación del ciclo agrícola, pero también de cualquier otro calendario que tenga el curso del año solar como base. Como equipo o instalación basta una pequeña apertura, p.ej. en el techo de una choza, de una casa o de un templo. Es la misma situación que nos hace saber Parsons (1932) de un rito practicado por los sacerdotes de los Zuni (véase Aveni y Hartung, 1981, pág. 67). La puerta de la casa debe ser cerrada para obscurecer el recinto. Antes se marca en el suelo el punto originado por la vertical que empieza en la apertura, p.ej. echando una plomada. En principio tenemos una cámara obscura y podemos observar el curso de la luz del sol a través del punto básico verticalmente señalado bajo la apertura en el techo. Una construcción adecuada para la observación se halla a mi parecer en el pozo de la cueva artificial de Xochicalco, Morelos (Tichy, 1980).

Hay grados de latitud señalados, en donde coinciden los pasos del sol por el cenit con ciclos calendarios, como p.ej. en el caso del tzolkín de los chortí. Bajo 15 grados de latitud la diferencia entre los dos pasos del sol por el cenit asciende a dos veces 52 días. Bajo la latitud de 18 grados, p.ej. en La Venta, son dos cuarentenas o cuatro veintenas, bajo la latitud de 19 grados, como en Cholula o Xochicalco son 72 días u ocho novenas, bajo 20,5 grados, como en Uxmal, son tres veintenas.

Girard tiene razón en opinar que las mejores condiciones para la invención del tzolkín agrícola están dadas en las regiones bajo 15 grados de latitud y además en la costa del Pacífico por causas climatológicas. No obstante, no quiero dejar fuera la posibilidad de que hayan existido ciclos agrícolas semejantes, bajo otros grados de latitud ya señalados. Preguntemos ahora: ¿en qué forma podría ser construido un calendario agrícola en Cholula o Xochicalco?

Podemos suponer los mismos ciclos parciales de 52, 40 y 36 días y una semejante simetría. Los pasos del sol por el cenit ocurren respectivamente bajo 19 grados de latitud norte el 16 de mayo y el 28 de julio. Entre el 17 de mayo y el 20 de junio hay 36 días y entre el 21 de julio, el solsticio de verano, y el 27 de julio hay otros tantos, es decir cuatro novenas. Los equinoccios aquí no se pueden reconocer como límites entre ciclos. Un ciclo de 52 días empezaría el 26 de marzo y finalizaría el 16 de mayo. Más agradable sería un ciclo de 40 días empezando el 7 de abril. Este día es interesante porque el sol el 7 de abril desciende en el horizonte con una desviación de 7 grados de Oeste a Norte. La desviación es la que indica el eje de Tenochtitlan con su Templo Mayor y de otros sitios más.

Por eso, dejemos empezar el calendario de 260 días con el ciclo de 52 días el 14 de febrero y también dejemos finalizarlo con 52 días. Sin embargo, hacen falta 4 días para ser el 31 de octubre y para cumplirse los 260 días. El primer día, el 14 de febrero posee una buena relación con respecto a una situación solar y a los ejes piramidales que tienen la desviación de 13,5 grados de Este a Sur. Direcciones de estas estructuras se conocen en Teotenango, Kobah, Nohpat y Cozumel. En los días del paso del sol por el cenit, el sol desciende en el horizonte con una desviación de 20 grados Oeste-Norte en el México central. Sin entrar más en detalle, es digno de mención el hecho de que es posible construir también para la latitud de 18 grados semejantes ciclos astronómicamente relacionados. Se empieza de la misma manera como en la latitud de 15 grados también el 10 de febrero con un ciclo de 40 días.

Hay bastantes razones para hacer válida la opinión de que haya existido una vez en Mesoamérica muy estrechas relaciones entre el ordenamiento del espacio y el ordenamiento del tiempo en coordinación con la vida económica y el culto. A partir del curso del sol se determinó la orientación del espacio y del tiempo en el viejo mundo. Las variaciones del curso del sol determinan en suma el curso de los fenómenos naturales, los de la atmósfera y de este modo se adapta el curso de las labores agrícolas de 260 días de duración de febrero a octubre. Probablemente se puedan hallar otros también al Sur del Ecuador. Es posible controlar y rectificar el calendario agrícola y sus ciclos con observaciones del paso del sol por el cenit con una muy alta exactitud.

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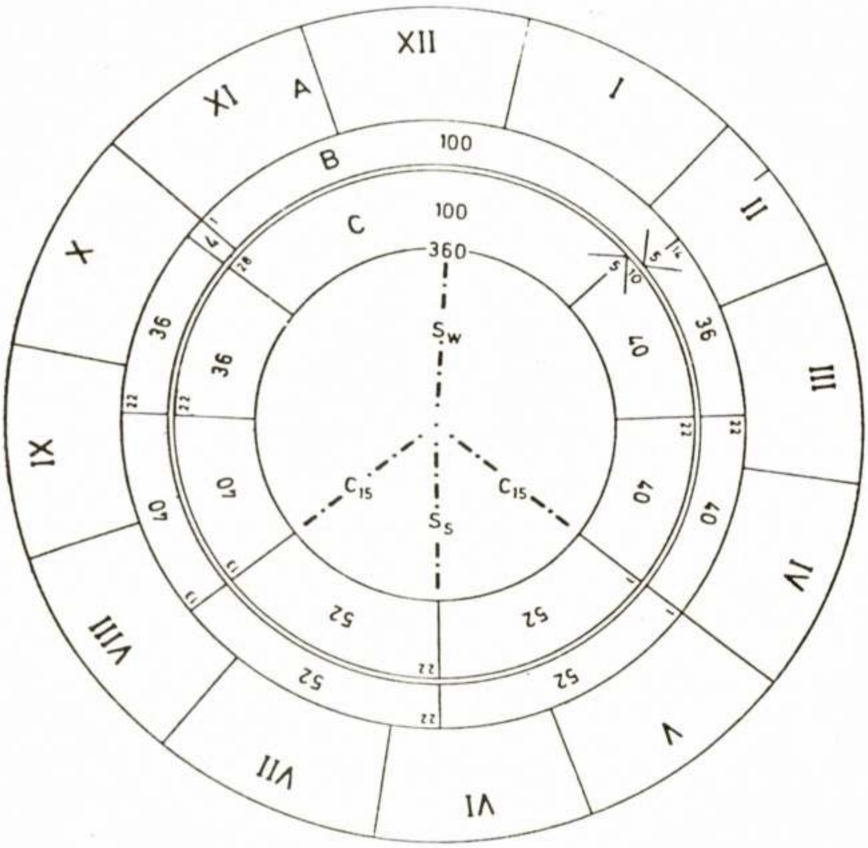
TABLA 1

El año agrícola en campos de quema en la montaña del centro y Sur de México. Ritos agrarios en Tepoztlán (Lewis, 1960).

Mes	temporada	labor	ritos agrícolas
enero febrero marzo abril	t. seca	última cosecha desmonte y roza colocación de piedras quemas	
mayo	lluvias	siembra del maîz	San Isidro el 15 de mayo bendición del maîz
junio		siembra: maîz, frijol, calabaza	
julio		deshierbo, lîmpia	
	pausa de lluvias		
agosto	lluvias	recalzar, acollar siembra de la segunda milpa	procesión en los campos a medidas de agosto
septiembre		primeras elotes vigilar	cruces en las milpas el 28 de septiembre
octubre		(sachar 2. milpa)	
noviembre	t. seca	cosecha: maîz, frijol, calabaza	
diciembre		cosecha del maîz transporte	

Tabla 2a El calendario agrícola de 260 días bajo 15° L.N.



A - meses cristianos
B - los ciclos parciales en posiciones simétricas
C - tzolkin chorti (vease 2b)

Tabla 2b El tzolkin chorti desde el 8 de febrero al 25 de octubre según Girard (1982) adaptado a los eventos solares

fechas		días	labor	
10/2 - 21/3	equinoccio de primavera	40	desmonte	-verano-
22/3 - 30/4	primer paso del sol por el cenit	40	quemas	
1/5 - 21/6	solsticio de verano	52	Milpa de primera	ciclo de las lluvias
22/6 - 12/8	segundo paso del sol por el cenit	52		
13/8 - 21/9	equinoccio de estate	40	Milpa de segunda	
22/9 - 27/10		36		-invierno-
		260		

Tabla 3a El calendario agrícola de 260 días bajo 19° L.N. (Construcción a base de la distancia de los días del paso del sol por el cenit)

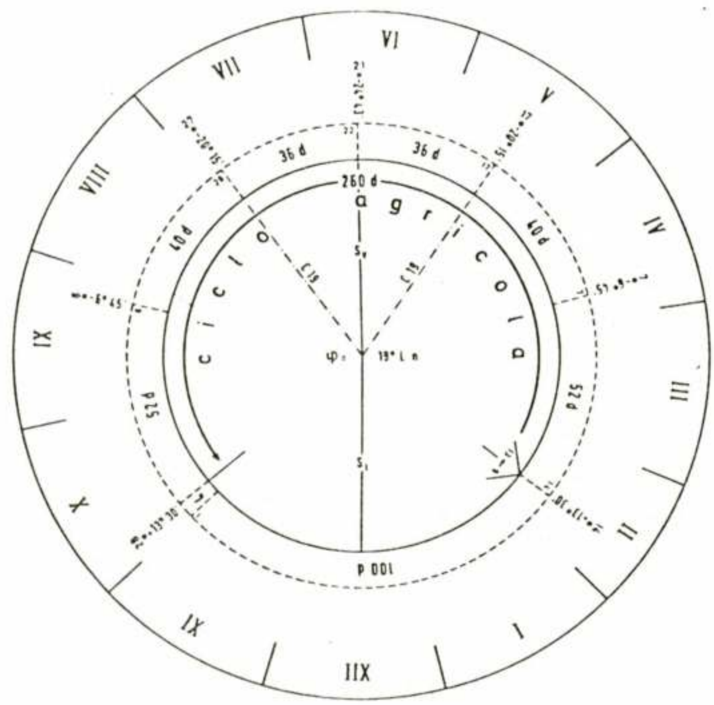


Tabla 3b Los días del paso del sol por el cenit entre 15° y 23°N, su distancia y las desviaciones de la puesta del sol

Latitud Norte	Pasos del sol por el cenit I – II	Distancia días	Períodos número	Desviación de la puesta del sol (acimut)	Lugar
15°	mayo 1 - agosto 12	103	2 x 52	+ 15°33'	Copán/Honduras
16°	mayo 4 - agosto 9	97		+ 16°40'	
17°	mayo 8 - agosto 5	89		+ 17°48'	Monte Albán
18°	mayo 12 - agosto 1	81	2 x 40	+ 18°58'	La Venta
19°	mayo 16 - julio 28	72	2 x 36	+ 20°08'	Cholula
20°	mayo 20 - julio 23	64		+ 21°21'	Tula
20°25'	mayo 22 - julio 21	60	3 x 20	+ 21°51'	Uxmal, C.Culiacán
21°	mayo 25 - julio 18	54		+ 22°34'	Mérida
22°	junio 1 - julio 11	40	2 x 20	+ 23°50'	Aguascalientes
23°	junio 10- julio 2	22		+ 25°07'	
23°26,5'	junio 21	0		+ 25°42'	Alta Vista /JB/

JOHANNA BRODA

Ciclos agrícolas en el culto: un problema de la correlación del calendario mexica

Este breve estudio aporta datos sobre la correlación del calendario mexica analizando la interrelación que existía en este calendario entre el clima y los ciclos agrícolas por una parte, y los ciclos rituales y míticos por otra. Las fuentes son la documentación etnohistórica del altiplano central en el último momento antes de la conquista y la documentación arqueológica de la reciente excavación del Templo Mayor de Tenochtitlan. A estas fuentes se les aplica un ánalisis en términos de antropología social vinculando la cuestión calendárica con las actividades económicas y sociales. Nos hemos preguntado acerca de la función social del ritual calendárico. El culto mexica era, además, expresión de la cosmovisión; abarcaba un conocimiento práctico y una filosofía de la naturaleza. En la última parte de este trabajo señalaré cómo el ciclo de Tlaloc en el Templo Mayor reflejaba a través del mito una concepción filosófica sobre los ciclos naturales de la lluvia y del maíz.

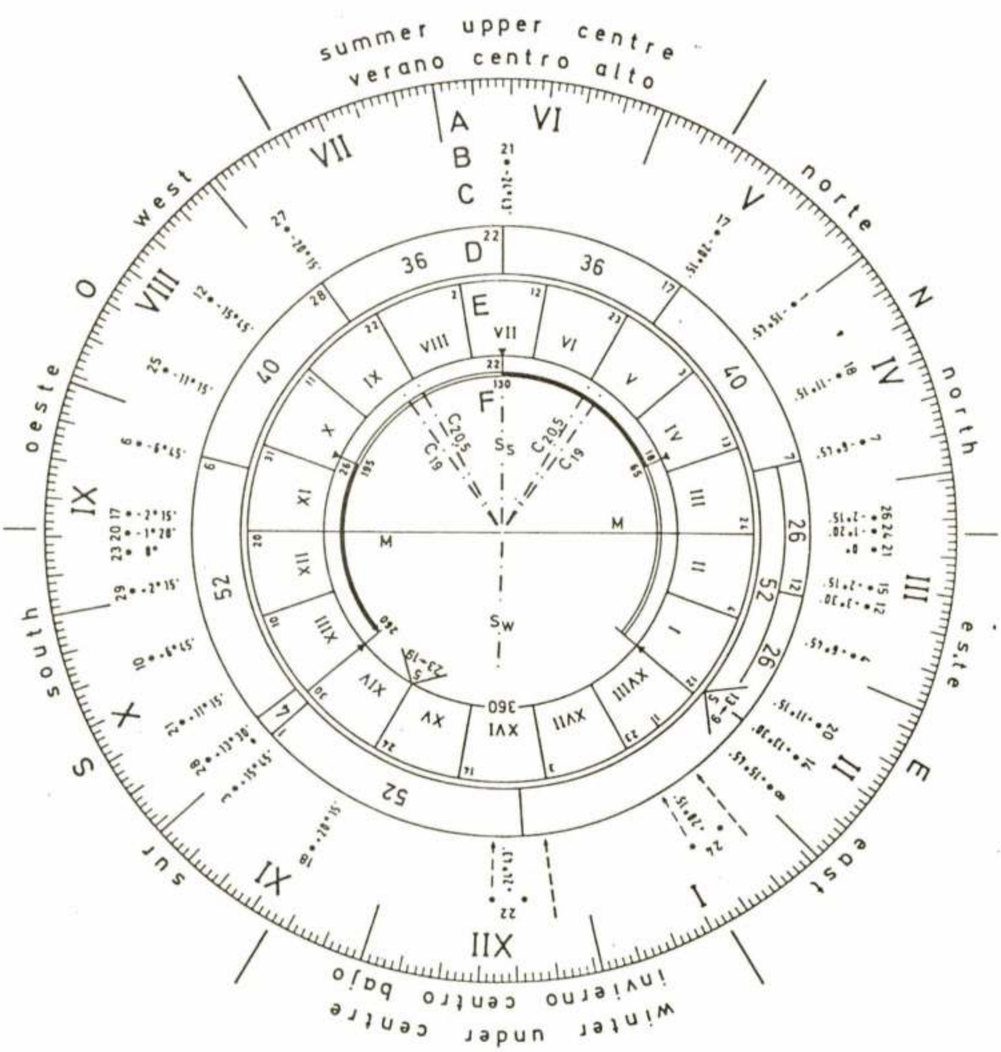
Presento aquí las conclusiones de un estudio monográfico más extenso sobre los ritos agrícolas (Ms.c), el cual, a su vez, forma parte de una serie de investigaciones que he llevado a cabo sobre la función social del culto mexica.[1] Este análisis ha mostrado que existía, sin lugar a dudas, una correspondencia entre los ritos, los fenómenos climatológicos y la agricultura. Las crónicas del siglo XVI dan abundante testimonio al respecto. Hay que concluir, por lo tanto, que si existía tal relación (la función del culto consistía precisamente en reforzarla), entonces debe haber existido algún método, aún desconocido, para mantener el calendario en concordancia con el año solar.

La correlación del calendario mexica

Para el presente análisis, es fundamental contar con una correlación fija que nos permita relacionar los datos sobre ceremonias y actividades económicas, con fechas exactas. Otro elemento necesario para llevar a cabo el análisis, son ciertos conocimientos básicos del clima, de la ecología y de los ciclos agrícolas en el altiplano central. A este respecto, la comparación con datos etnográficos modernos es de gran utilidad.[2] Es de suponer que los factores climatológicos y ecológicos han mantenido una constancia, a grandes rasgos, desde el siglo XVI, lo cual nos permite hacer tales comparaciones.[3]

CUADRO 1

Correlación del calendario mexica según Tichy y esquema de orientaciones de los edificios pre-hispánicos



CLAVE DEL CUADRO 1

A- Calendario gregoriano para el año 1975

B- Los días con direcciones de la salida del sol correspondientes al círculo C.

C- Desviación axial de las pirámides contada a partir del E; ángulos negativos de E a N indican la salida del sol en la mitad estíal; ángulos positivos de E a S corresponden a la parte invernal. Para la puesta del sol se aplican los ángulos negativos en la mitad estíal y los ángulos positivos en la mitad invernal. La orientación hacia el O es determinante para la mayoría de las pirámides.

D- "Tonalpohualli fijo", o calendario solar de 260 días + 100 días + 5 días nemontemi, y sus subdivisiones.

E- Calendario mexica con 360 + 5 días. 18 períodos de 20 días + 5 nemontemi (19.-23.11.); más comúnmente, los nemontemi son colocados antes de I Atlacahualo que comienza el 12 de febrero. Este principio de año coincide con los datos de Sahagún, cambiados a fechas gregorianas. Los 6 períodos de 60 días que se registran en el círculo concéntrico exterior, indican los 6 rumbos del universo (E-N-O-S-Centro alto y Centro bajo).

F- Tonalpohualli de 260 días, dividido en 4 períodos de 65 días o veinte semanas de 13 días.

S_s y S_w - Solsticios de verano y de invierno.

C_{19} y $C_{20,5}$ - Pasos del sol por el cenit en las latitudes de 19^o y $20,5^oN$.

M- Días de la mitad del año, marzo 24 y septiembre 20.

CUADRO 1, según Tichy, diagrama 16.2.1977, basado en Tichy 1976, fig.9; el texto con ligeras modificaciones de la autora.

Esta tarea no se había emprendido anteriormente. Numerosos investigadores han negado la correspondencia entre el culto mexica, las estaciones y la agricultura. Un investigador tan destacado como Karl Anton Nowotny que figura entre los mejores conocedores de las fiestas del calendario mexica, negó, por ejemplo, la relación entre los sacrificios de niños y los fenómenos climatológicos, suponiendo que estos sacrificios, con el transcurso de los años, se habían ido prolongando cada vez más desde el primer mes de I Atlcahualo hasta IV Huey tozoztli.[4] Si el año indígena perdía cada cuatro años un día, esta diferencia sumaba 25 días en 100 años. Es decir, en 100 años el calendario se hubiera desfasado por más de un mes indígena. Nowotny rechazó rotundamente la posibilidad de una correspondencia exacta entre las fiestas y el año solar debido a la supuesta ausencia de métodos para corregir el calendario (1968a, b).

Michel Graulich, partiendo de la misma suposición, propone otra hipótesis difícil de comprobar: que los nombres de los meses mexica tuvieran su origen en el año 682 d.C., durante la época clásica, cuando habían correspondido con los fenómenos climatológicos, mientras que en el momento de la conquista se encontraban aproximadamente 5 meses europeos fuera de correspondencia con el año solar. El ciclo calendárico mayor en el que fiestas y fechas solares hubieran coincidido nuevamente, serían 1460 años. Graulich hace un análisis estructural del contenido mítico de las fiestas, tomando como punto de referencia la supuesta correspondencia para el año 682 d.C. (1976, 1980).

El presente trabajo se basa en la correlación fija entre meses prehispánicos y fechas solares que ha sido propuesta por Franz Tichy.[5] No podemos explicar aquí en detalle la compleja metodología aplicada por Tichy para elaborar esta correlación; sólo señalaré que en ella se combinan investigaciones arqueo-astronómicas, arqueológicas, etnohistóricas, de etnografía y geografía cultural moderna. El punto de partida es el principio de orientación de pirámides y centros ceremoniales prehispánicos. En la última década, Anthony F. Aveni, Horst Hartung, Tichy y algunos otros autores han emprendido un estudio sistématico de las desviaciones de los puntos cardinales en los ejes principales de edificios y sitios arqueológicos.[6] En base a estas mediciones de campo, Tichy logró establecer un sistema de ángulos recurrentes en las desviaciones, sistema que se vincula al mismo tiempo con ciertas subdivisiones básicas del calendario y conduce así a una correlación fija de éste con el año solar. (Véase Cuadro 1)

El particular interés de estas investigaciones para la etnohistoria consiste en el hecho de que Tichy llegó, a partir de datos obtenidos independientemente de la documentación etnohistórica, a reconstruir la estructura interna del calendario prehispánico, y a establecer su correlación fija. Es de notar que esta correlación comprueba, además, la exactitud de las fechas que dio fray Bernadino de Sahagún para los 18 meses aztecas en el Libro II de su Historia General. Por lo tanto, la correlación de Tichy que usamos en el siguiente análisis, coincide con las fechas de Sahagún (Tichy 1980). (Véase Cuadro 2)

CUADRO 2

Correlación fija del calendario mexica

(Según Sahagún, Libro II; Tichy 1976, véase Cuadro 1)

MESES	PREHISPANICOS	CALENDARIO CRISTIANO (GREGORIANO)
I	Atlcahualo	12.2. - 3.3.
II	Tlacaxipehualiztli	4.3. - 23.3.
III	Tozoztontli	24.3. - 12.4.
IV	Huey tozoztli	13.4. - 2.5.
V	Toxcatl	3.5. - 22.5.
VI	Etzalcualiztli	23.5. - 11.6.
VII	Tecuilhuitontli	12.6. - 1.7.
VIII	Huey tecuilhuitl	2.7. - 21.7.
IX	Tlaxochimaco-Miccailhuitontli	22.7. - 10.8.
X	Xocotlhuetzi-Huey miccailhuitl	11.8. - 30.8.
XI	Ochpaniztli	31.8. - 19.9.
XII	Teotleco	20.9. - 9.10.
XIII	Tepeilhuitl	10.10.- 29.10.
XIV	Quecholli*	30.10.- 18.11.*
XV	Panquetzaliztli	19.11.- 8.12.
XVI	Atemoztli	9.12.- 28.12.
XVII	Tititl	29.12.- 17.1.
XVIII	Izcalli	18.1. - 6.2.
Nemontemi		7.2. - 11.2.

* En la correlación de Tichy (Cuadro 1), se intercalan aquí los 5 nemontemi. El problema de los nemontemi está lejos de estar resuelto. Sahagún los coloca entre XVIII Izcalli y I Atlcahualo, sistema que seguimos aquí provisionalmente.

Sabemos que los antiguos mexicanos conocían desde la época clásica varios métodos que les permitían observar la verdadera duración del año tropical (365,25 días), conocimiento que se encuentra reflejado en inscripciones jeroglíficas mayas de Copán, Palenque, Tikal y Quiriguá.[7] Entre los métodos de observación del año solar figura el observatorio de Xochicalco, orientado hacia el cenit y el solsticio de verano (Broda, Ms.b., fig. 18). La verdadera duración del año también se puede conocer en base a la recurrencia de la posición de ciertas estrellas. Parece que los mexica registraban con tal propósito la salida helíaca de las Pléyades a fines de mayo que ocurría poco después del primer paso del sol por el cenit. Tal coincidencia confería a estos fenómenos una doble validez en la latitud geográfica de Tenochtitlan.[8]

Estos métodos permitían mantener el calendario en correspondencia con el año solar, las estaciones y los ciclos agrícolas. Sin embargo, no se ha descubierto hasta hoy en día el método exacto con el cual los antiguos mexicanos hacían coincidir los fenómenos astronómicos con los ciclos calendáricos, los cuales, como múltiples de 20 (260 días, 360 días; 52, 104 años, etc.) no admitían las intercalación de un día sin que se estropeara la armonía interna del sistema. El presente estudio etnohistórico no contribuye a solucionar este problema desde el punto de vista calendárico-cronológico sino que más bien aporta datos sobre la manera en que se fijaba, ritual y socialmente, en el calendario mexica la recurrencia de los fenómenos climatológicos y agrícolas. El culto era el puente entre astronomía, calendarios, ciclos naturales, economía y cosmovisión, formando un todo que era legitimado por medio de la religión.

Ciclos agrícolas y culto mexica

La característica geográfica fundamental de Mesoamérica ha sido, desde siempre, su enorme variabilidad de alturas, climas y suelos. Este hecho ya fue señalado muy pertinentemente a fines del siglo XVI por el cronista fray Francisco de las Navas: "en estas partes de las Indias hay diferentes climas que casi en todo el año se siembra y coje maíz en las tierras cálidas y templadas y en las serranías" (<u>CFN</u> 150)

A pesar de estas condiciones ecológicas tan diversas que perduran hasta hoy en día, se pueden distinguir, a grandes rasgos, dos ciclos en el altiplano central: el de regadío y el de temporal. Los sistemas agrícolas mesoamericanos han mantenido una continuidad básica desde la época prehispánica hasta la actualidad. En el ciclo de regadío se siembra en enero o febrero y se cosecha en junio y julio; a los dos meses ya puede haber jilotes. En el ciclo de temporal existe una gran variabilidad en la siembra según la altura y la calidad de los terrenos, aún en los que pertenecen a un mismo pueblo. Naturalmente, esta variación es aún más grande entre diferentes lugares. La siembra se hace hoy día entre marzo y junio. Para la época prehispánica informa Durán que la siembra de los montes se iniciaba ya en febrero, porque allí empezaban los aguaceros antes que bajaran a los llanos: "y sembrábanlos tan temprano a causa de la humedad de los montes, que, según ellos

dicen, siempre empiezan por allí los aguaceros muchos días primero que bajen a los llanos" (1967 I: 292).[9]

Lo más general era que se sembrara entre fines de abril y principios de junio, y la cosecha tenía lugar entre fines de octubre, noviembre y diciembre. Veamos la correspondencia entre estos ciclos y los ritos de los meses mexica. Todos los datos que aquí se presentan de manera resumida se basan en citas detalladas de las crónicas del siglo XVI, y su interpretación se combina con datos etnográficos actuales.[10]

El ciclo de regadío

El ciclo de regadío tenía lugar en Tenochtitlan entre los meses XVIII Izcalli/I Atlcahualo y VI Etzalcualiztli (enero/febrero hasta junio). El primer mes del año, según Sahagún, I Atlcahualo, tenía una serie de variantes de su nombre: se llamaba también Atlmotzacuaya-Quahuitlehua-Xilomanaliztli.

Atlcahualo	"se detiene el agua"
Atlmotzacuaya	"se ataja el agua"
Quahuitlehua	"levantamiento de los postes"
Xilomanaliztli	"ofrenda de jilotes"[11]

Los tres primeros nombres con sus ritos correspondientes se referían al hecho de la falta de agua en esta época del año, y a ritos mágicos para atraer la lluvia. El último nombre, Xilomanaliztli, contenía una referencia al comienzo del ciclo agrícola de regadío, puesto que ya se hacían ofrendas de primicias de jilotes o más bien, se pedía que éstos salieran pronto. Al mismo tiempo empezaban los sacrificios de niños. Estos niños representaban a los tlaloque, los pequeños servidores del dios Tlaloc, y se identificaban con cerros específicos en los alrededores de Tenochtitlan. Se trata de ritos mágicos para atraer la lluvia en la época del máximo estío que comienza en febrero y se prolongará hasta mayo. Al mismo tiempo, estos sacrificios se relacionaban con el ciclo de regadío a través de la edad de los niños que iba aumentando conforme crecía el maíz (Motolinía 1967: 64, 65). Tenían lugar entre I Atlcahualo (a veces empezaban unos meses indígenas antes) y IV Huey tozoztli; en este último mes, correspondiente a abril, culminaban en la gran fiesta de Tlaloc en el cerro del mismo nombre y en el remolino de la laguna, Pantitlan (Broda 1971: 272-81).

El ciclo de regadío terminaba en Tenochtitlan con la fiesta de VI Etzalcualiztli (23.5.-11.6.).[12] A la mitad de este mes la gente preparaba en sus casas la comida del etzalli que eran "unos bolitos de masa de maíz guisados con frijoles". Durán informa que en esta época del año los elotes eran ya bastante grandes y, debido a que el año ofrecía buenas perspectivas, se daba permiso general para comer el etzalli (1967 I: 259). Esta comida denotaba abundancia y la recibían también unos limosneros que andaban de casa en casa,

bailando "el baile del etzalli" en representación del dios Tlaloc. Estos limosneros traían prosperidad a las casas donde entraban. Según el cronista Juan de Tovar:

> En estos días, los labradores habían ya labrado la tierra y salían en el hábito... (de Tlaloc)... diciendo al pueblo pués por los labradores gozarían de tal semilla de pan como el maíz cuya insignia traían, que era razón se lo gratificasen y así todos les echaban en las ollas muchas cosas de comida, especialmente de ésta de frijoles y maíz... y así todos se holgaban estos días porque en ellos descansaban de haber labrado y cultivado la tierra. (Kubler y Gibson 1951: 25)

En esta fiesta observamos otro fenómeno interesante: la cosecha del ciclo de regadío se encuentra íntimamente mezclada con ritos referentes al ciclo de temporal, puesto que en la misma fiesta se celebraba la terminación de la siembra de temporal (o de las primeras labores), y se hacían ritos para que descansaran los instrumentos de trabajo. El ciclo de regadío hasta aparece subordinado al simbolismo principal de Etzalcualiztli. Las ofrendas de matas verdes de maíz, de jilotes, de elotes y la comida de etzalli-- procedentes todos ellos del ciclo de regadío-- servían como analogía mágica mediante la cual se quería provocar un igual desarrollo de la siembra de temporal. Así la comida del etzalli denotaba abundancia y pronosticaba un feliz crecimiento del maíz del temporal que apenas se había sembrado. Estas circunstancias señalan a nivel simbólico que, de hecho, se atribuía mayor importancia económica al ciclo de temporal, y que el ciclo de regadío era considerado como secundario.

Otro hecho sumamente relevante tenía lugar durante el mes de Etzalcualiztli. Era el comienzo pleno de la estación de lluvias. Aunque solían ocurrir temporales esporádicos durante los meses anteriores, éstos no se hacían verdaderamente abundantes hasta este mes. Este acontecimiento era celebrado mediante el sacrificio del dios Tlaloc y de su esposa Chalchiuhtlicue en el Templo Mayor, el día último del mes; sacrificio que denotaba la culminación de los ritos de la estación seca, principalmente de los sacrificios de niños por medio de los cuales se había pedido el agua. Los ejercicios rituales que los sacerdotes de Tlaloc hacían a lo largo de Etzalcualiztli, tenían asimismo la finalidad de provocar por medios mágicos, el deseado comienzo de las lluvias (Broda 1971: 283-86, 290-91). Nos referiremos más adelante a la importante cuestión de la división del año en estación seca y época de lluvias.

El ciclo de temporal

En cuanto al ciclo de temporal hemos visto que hasta la actualidad, la fecha de la siembra depende de factores de altura y del microclima en terrenos específicos; se inicia, por lo general, cuando han caído las primeras lluvias. En el culto mexica se pueden detectar a lo largo de los meses I Atlcahualo hasta VI Etzalcualiztli (febrero-junio), ritos cuya finalidad era la de fomentar el buen desenlace del ciclo agrícola de temporal. La fiesta propriamente dicha que iniciaba ritualmente la siembra de

temporal, era IV Huey tozoztli (13.4.-2.5.); en ella se usaban las matas verdes del maíz de regadío, para atraer la fertilidad para el ciclo de temporal. La fiesta giraba alrededor de la bendición del maíz para la siembra (in cintli, xinachtli iez). Estas mazorcas se habían guardado en manojos de a siete desde la cosecha del año pasado; tales manojos se llamaban ocholli, pero también llevaban el nombre de "dios mazorca", cintli o cinteotl. Adornados con papel rojo goteado de ulli líquido, estas mazorcas eran llevadas por las doncellas (ichpopochtin) al templo de Chicomecoatl, el Cinteopan. "Allí éstas... se convertían en corazones, en los corazones del granero... en maíz para la siembra" (CF II: 60-62). Al volver a sus casas, la gente las ponía dentro de la troje, convirtiendo así el demás maíz almacenado en maíz para la siembra la cual iba a tener lugar pronto.

Con respecto a esta fiesta, la comparación con datos etnográficos modernos es sumamente relevante: la fiesta de la Santa Cruz que se celebra hoy en el día 2 de mayo en las regiones indígenas de México y Guatemala, es junto con el día de los muertos aquella fiesta católica que ha recogido más elementos de la tradición prehispánica. Se trata precisamente de una fiesta de la bendición del maíz para la siembra y del inicio del ciclo agrícola de temporal, en la que se invoca, además de la deidad del maíz, a la tierra y a las lluvias. La diosa prehispánica del maíz, Chicomecoatl, merge con la deidad de la tierra y ambas llegan a ser personificadas en el símbolo católico de la Santa Cruz (sin embargo, generalmente se adoran cuatro cruces y su simbolismo dista mucho del católico). Los lugares de culto son fuentes y ríos, sobre todo, lo alto de ciertos cerros donde los ritos más importantes tienen lugar durante la noche o al amanecer.[13]

Es de notar que en el mes prehispánico de IV Huey totoztli terminaba también el ciclo de los sacrificios de niños que se habían hecho desde febrero hasta abril "para que los tlaloque diesen agua" (CF II: 5). Aunque hemos visto que los sacrificios de niños correspondían por una parte a las fases de crecimiento de las sementeras de regadío, por otra producían la lluvia necesaria para el inicio de la siembra de temporal. Esto es también la explicación porque terminaban justo en el mes de la siembra de temporal, aunque en esta época todavía no se había garantizado plenamente la caída de las lluvias.

Curiosamente, según los datos etnográficos actuales de Citlala, se hacen en la fiesta de la Santa Cruz ofrendas de ropa de miniatura por los niños que han muerto en el pueblo desde la fiesta del año anterior. "No debe faltar ninguno, por que ellos son 'acompañantes' de la Santa Virgen de la Cruz', y así le ayudarán a hacer que llueva pronto; los niños muertos 'ya han alimentado a la tierra', están cerca de ella" (Olivera 1979: 154). De manera sorprendente encontramos aquí la sobrevivencia de los dos elementos básicos del culto de los niños muertos ("sacrificios de niños", en la época prehispánica): su relación con la lluvia y con la agricultura.

Durante el siguiente mes prehispánico, de V Toxcatl (3.-22.5.), continuaban las súplicas y los ritos mágicos por atraer la

lluvia que culminaban, como hemos visto, en la fiesta del dios Tlaloc, en VI Etzalcualiztli. Hasta entonces ya se había sembrado, y la entrada de las lluvias estaba plenamente garantizada.

Actualmente, los campesinos de Huexoyucan, en el altiplano de Tlaxcala, conciben el año agrícola (de temporal) dividido en tres ciclos de trabajo, de aproximadamente tres meses cada uno. El primer ciclo es el de la siembra e incluye la siembra, la primera labra, la segunda labra y el aterrado (abril-junio aproximadamente). El segundo ciclo supone tres meses de descanso del trabajo de la tierra (julio-septiembre). En esta época los campesinos tienen tiempo para dedicarse a otras labores, hoy día es el trabajo temporal y migratorio. La dobla que se ejecuta en este tiempo, no exige una mano de obra fuerte. El tercer ciclo significa tres meses de trabajo del segundo ciclo agrícola, o sea todas las actividades relacionadas con la cosecha incluyendo el amogotar, la pizca, la seca, la limpia, el almacenaje, el barbecho y la viga, que abarcan de fines de septiembre o octubre hasta diciembre.[14]

De acuerdo a la misma secuencia de ciclos que existe en la actualidad, la siguiente fiesta prehispánica de un contenido agrícola predominante era XI Ochpaniztli (31.8.-19.9.). En ella se celebraba el casamiento ritual de la diosa madre de la tierra con el dios solar, y como hijo nace Cinteotl, el dios mazorca. En relación al abundante simbolismo agrícola y de la fertilidad presente en Ochpaniztli (ofrendas de primicias de maíz y de otros elementos), numerosos autores han sugerido que se trate de la fiesta de la cosecha prehispáncica. Sin embargo, E. Seler quien fue el primero en proponer esta interpretación, se basa en una analogía equivocada con las condiciones climáticas europeas, donde la cosecha efectivamente tiene lugar en esta época. En México sólo se da la cosecha en tierras calientes (actual edo. de Morelos, por ejemplo), pero faltan aproximadamente dos meses para que las cosechas tengan lugar en las condiciones climáticas del altiplano central.

Según lo que hemos visto, en relación con las fiestas anteriores, en el culto mexica no se celebraban tanto los fenómenos acabados gracias a los dioses por haberlos concedido, sino que la principal función de los ritos era la de provocar un buen desenlace de los fenómenos deseados. Así, los sacrificios de niños debían atraer las lluvias y garantizar el crecimiento de las sementeras de regadío. IV Huey tozoztli era la fiesta en preparación de la siembra donde las mazorcas secas eran transformadas mediante los ritos en maíz para la siembra. En Etzalcualiztli hemos visto que se celebraba el comienzo de la cosecha de regadío y al mismo tiempo significaba el desenlace de la estación de lluvias. De la misma manera, XI Ochpaniztli no era la fiesta de la cosecha, sino que su propósito era el de conjurar, mediante los ritos, el buen cumplimiento de la maduración del maíz, mientras que la cosecha sólo tenía lugar unos dos meses después, correspondientes a XIV Quecholli (noviembre) y XV Panquetzaliztli (noviembre/diciembre) respectivamente. Encontramos una comprobación de esta interpretación en el hecho de que en esta última época ya no se

hacía ninguna fiesta de la cosecha propiamente dicha, a diferencia de la concepción católica de expresar mediante el culto el agradecimiento a dios por haber concedido los frutos agrícolas.

Con esto pasamos al tercero y último sub-ciclo agrícola, el correspondiente a los meses de octubre y diciembre y la terminación del ciclo de temporal. Esta parte del año, a partir de octubre, corresponde también climáticamente al final de la estación de lluvias. Es cuando se hacían en Tenochtitlan las ceremonias a los cerros y a los dioses del pulque. Quizás, se puede explicar el culto de los tlaloque en su aspecto de cerros en el siguiente sentido. Cuando empezaba la estación seca, el culto de los cerros significaba que ahora éstos estaban reteniendo el agua para luego soltarlo cuando empezaban de nuevo los sacrificios de niños. Además de esto, los cerros tenían una relación particular con varias actividades que se iniciaban en esta época del año como era la caza, el cortar madera para la construcción, el desmonte etc. Todas estas actividades se derivaban de hecho de los cerros.

Los cerros estaban también específicamente relacionados con el cultivo del maguey al cual los campesinos se dedican sobre todo en la época seca. No sólo se da el mejor pulque en la estación seca, sino que también es cuando se trasplantan los magueyes y después de las cosechas se arreglan los bordes de los terrenos terraceados donde están plantados los magueyes. El maguey tiene un sentido muy unido a la agricultura de temporal, sobre todo al cultivo con terracería donde se planta para evitar la erosión del suelo.[15] Al mismo tiempo, el maguey sirve para la producción del pulque y son bien conocidos los usos múltiples de esta planta mesoamericana que la ha convertido en el símbolo absoluto de la fertilidad. Las borracheras rituales que tenían lugar en estos meses prehispánicos, se vinculaban con el culto de los cerros, y en este aspecto eran una expresión de la cosecha. Los dioses del pulque eran al mismo tiempo dioses del desmonte (llevaban el hacha de carpintero en la mano) y estaban íntimamente relacionados con los dioses de la lluvia y de los cerros; ambos eran dioses patrones de lugares concretos que compartían varios rasgos iconográficos. Estos dioses se festejaban en la época del año apropiada para la serie de actividades que representaban (XII Pachtontli y XIII Huey pachtli-Tepeilhuitl).[16]

En el mes siguiente, XIV Quecholli (30.10.-18.11.), empezaban las cazas de venados, jabalíes, ansares, grullas y patos, y se hacían ceremonias al dios de la caza que culminaban en la gran fiesta de Mixcoatl-Camaxtli (CFN: 167-69). Esta fiesta demuestra la importancia que aún tenía la caza en la vida y mentalidad de los mexica. Octubre-noviembre efectivamente son los meses cuando los animales de caza ya no tienen cría, habiendo procreado en época caliente; por lo tanto es cuando se les puede cazar.[17] Además, llegan en esta época los pájaros migratorios del Norte (la Florida etc.), entre los que se mencionan los ansares, las grullas y los patos silvestres, y sobre todo el flamenco cuyo nombre en nahuatl, quecholli o tlauhquechol, ha dado el nombre al decimocuarto mes (Torquemada 1975-80, t.3, Libro X: 403, 426 y 427).

Por otra parte, éste y el siguiente mes de XV Panquetzaliztli (19.11.-8.12.) eran la época apropiada para iniciar las guerras que seguían hasta XVII Tititl y XVIII Izcalli (Kubler y Gibson 1951: 32). El hecho de que se hicieran las campañas militares después de haber terminado las cosechas y los trabajos agrícolas, demuestra que la economía del México prehispánico estaba todavía determinada por la agricultura.

En XV Panquetzaliztli se celebraba la fiesta del patrón del grupo étnico mexica, Huitzilopochtli, con un destacado significado político y guerrero, conectado con el culto solar. El solsticio de invierno tenía lugar unos días después, durante el mes de XVI Atemoztli (9.-28.12.), que en términos míticos significaba el culto del sol en su paso por el río del inframundo (Cfr. Carrasco 1979: 57). En este último mes se enlazaba el simbolismo solar con el de la lluvia y de los cerros. Cuando caían los primeros aguaceros en los montes, Tlaloc recordaba a los hombres que empezaran a pedir la lluvia mediante los sacrificios de niños, iniciándose de esta manera de nuevo el ciclo de ritos que se extendería a lo largo de toda la estación seca (Broda 1971: 312 y 313).

En la siguiente fiesta, de XVII Tititl (29.12.-17.1.), encontramos ciertos rasgos que parecen simbolizar al maíz "viejo" en la época fría y seca del invierno. Se daba culto al dios del fuego Xiuhtecutli-Huehueteotl, el más anciano de todos los dioses, así como a Ilamatecuhtli, la "señora vieja' que, en cierto modo, representaba al maíz viejo y al barbecho. Se hacían unas extrañas ceremonias con su "troje de maíz' a la cual se prendía fuego (CF II: 144 y 145). Es de notar que en esta época del año se limpian actualmente los trojes, se saca el maíz viejo (del año anterior) y se mete el maíz nuevo que acaba de secarse después de las cosechas.[18]

En XVIII Izcalli (18.1.-6.2.), mes cuyo nombre quiere decir "crecimiento", se hacían ritos para el crecimiento de los niños, estirándoles sus extremidades para que crecieran. Cabe pensar en la posibilidad de que existía un cierto paralelo entre los niños y las sementeras de regadío que se empezaban a cultivar en este momento. El siguiente mes de I Atlcahualo, marcaba no solamente la siembra de regadío y el inicio de los sacrificios de niños a gran escala, sino que, además, para Tenochtitlan, era el principio del año civil y cronológico, según informa Sahagún (CF II: 1). Además, era un mes de borracheras generalizadas; hasta a los niños pequeños se les hacía tomar pulque (CF II: 148-53).

Culto, cosmovisión y "filosofía de la naturaleza"

Finalmente, quisiera añadir otra reflexión sobre el contenido mítico del ciclo anual de fiestas. De acuerdo con los fenómenos climatológicos, la división básica del año se hacía en Xopan, lit. "tiempo verde"-- la estación de lluvias-- y tonalco, "tiempo de sol, y calor"-- la estación seca.[19] Tlaloc como el dios de las lluvias, del agua y de la fertilidad en general, presidía sobre la mitad del año que se iniciaba con la fiesta de VI Etzalcualiztli. Era la estación de lluvias, la "época oscura" del año relacionada

con la noche, la luna, con Venus y las estrellas (incluyendo a las Pléyades), así como con los muertos y el inframundo. Fue durante esta época que la planta del maíz crecía y maduraba, y este proceso en su complicada mitología fue representado en el culto durante los meses de VII Tecuilhuitontli-XI Ochpaniztli (junio-septiembre). La maduración del maíz parece haber sido equiparada, a nivel mítico, con el viaje del sol por el inframundo. Esta era la época del "Sol Nocturno", símbolo de Tlaloc.[20]

Por otra parte, la mitad del año llamada tonalco que se iniciaba con XV Panquetzaliztli, era presidida por el sol como deidad del cielo diurno. Esa deidad era Huitzilopochtli y su nacimiento en el cerro Coatepec era celebrado en los ritos de Panquetzaliztli. La terminación de la cosecha de temporal pertenecía a esta parte del año -tonalco, el calor del sol.[21]

Esta división mítica del año tiene un particular interés ya que se ve representada mediante numerosos símbolos en el dualismo del Templo Mayor, fenómenos que pueden ser analizados en los hallazgos de la reciente excavación de este templo. En otro trabajo exploro con mayor detalle este simbolismo (Ms.a), lo cual me ha permitido concluir que esta división del año, en estación seca y de lluvias, y su interrelación con el ciclo agrícola del maíz del temporal, imprimieron su huella profunda a la cosmovisión mexica, reflejándose no sólo en la estructuración misma del ciclo anual de fiestas, sino también en la arquitectura, las esculturas y las ofrendas del Templo Mayor.

A la estación seca pertenecía el culto de los tlaloque como dioses de los cerros. Los cerros que retenían el agua en su interior, para soltarlo de nuevo en tiempo de lluvias. Los cerros tenían también una relación más profunda con el maíz, ya que éste era guardado en su interior. Los tlaloque eran los dueños originales del maíz y éste último tenía que ser adquirido por los hombres mediante un contrato para con los dioses de la lluvia. Este contrato por excelencia eran los sacrificios de niños, nextlahualli, "la deuda pagada", y ellos tenían lugar precisamente en la época más seca del año (Cfr. Broda 1971: 272-76). Los aspectos mencionados muestran una coherencia interna entre observación de la naturaleza, actividades económicas y sociales, y la superestructura religiosa. En cierto modo, configuraban lo que podríamos llamar "la filosofía mexica de la naturaleza". En cuanto a las actividades sociales y económicas, el calendario mexica mostraba una planeación tan detallada que en él cada cosa y cada actividad tenían su momento apropiado cuando debían llevarse a cabo fielmente. Sólo era posible esta coordinación de los ritos con la vida social, si se usaba algún método para mantener el calendario en correspondencia con el año solar.

La aportación de este breve trabajo no ha sido la de derrocar la modalidad de cómo se hacían estas correciones periódicas del calendario sino que más bien la de llamar la atención sobre la estructura interna del culto en su relación con los ciclos recurrentes del clima y de la agricultura. El tema del contenido de los ritos también debe ser tomado en cuenta al abordar la cuestión cronológica del calendario mexica.

NOTAS

1 Broda 1971; 1978; 1979; 1982a, b; Ms.a, b.

2 Los datos etnográficos que usé para la comparación provienen de la región chinampera del Valle de México (San Luis Tlaxialtemalco, Xochimilco) (Peña 1978), con una agricultura de irrigación, y del altiplano de Tlaxcala (San Mateo Huexoyucan) (Bilbao Ms.), donde el cultivo es de temporal. Los datos comparativos sobre la Fiesta de Santa Cruz (véase adelante) se derivan de más lejos, de Citlala, Guerrero, una región nahua donde se ha conservado una cultura indígena muy tradicional. (Cfr. Olivera 1979; Sepúlveda 1973; Suárez 1978).

3 Con esto no quiero decir, de ninguna manera, que en otros campos de la economía y estructura social y política los cambios que ocurrieron a partir de la conquista, no hayan tenido una trascendencia fundamental. Más aún que estamos hablando del Valle de México, centro del estado mexicano moderno.

4 Los números romanos se refieren a la secuencia de los meses según Sahagún (HG y CF), en la cual el año empieza con I Atlcahualo (cfr. Cuadro 2).

5 Tichy 1976a, b; 1978; 1980; Ms.

6 Aveni ed. 1975, 1977; Aveni 1980; Aveni, Hartung y Buckingham 1978; Aveni, Hartung y Kelley 1982; Hartung 1975, 1977; Tichy cfr. nota 5, y la bibliografía citada en Aveni 1980 y Broda Ms.b.

7 Cfr. Aveni 1980: 170-73. Se han encontrado referencias que reflejan tales conocimientos, sin embargo, no se conoce hasta el momento ningún registro carente de ambiguedad que demuestre la práctica periódica de correcciones del calendario solar.

8 Cfr. Broda 1982b. La observación de la salida helíaca de las Pléyades en combinación con el primer paso del sol por el cenit, parece haber sido importante desde la época teotihuacana. Alrededor del año 150 d.C., ambos fenómenos coincidían en la misma fecha en la latitud geográfica de Teotihuacán (19° 42': 18 de mayo) (Aveni 1980: 225).

9 Hasta hoy en día, en la tan destruída ecología del Valle de México, se conservan marcadas diferencias climatológicas. En las lomas de la sierra del Ajusco, por ejemplo los pueblos de Ajusco, Contreras etc., suelen caer aguaceros durante los meses de diciembre y enero dada la diferencia de elevación de unos 200-400m. con las partes centrales del Valle.

10 Según he indicado arriba, esta ponencia presenta sólo una síntesis de un estudio más extenso que estoy preparando para su publicación (Ms.c). La interpretación general que se maneja de las fiestas de los meses mexica se basa, naturalmente, en toda una serie de estudios previos que me han permitido lograr esta comprensión global. (Cfr. Broda 1971; 1978; 1979; 1982a, b; Ms.a, b).

11 Las fuentes se citan en Broda 1969: 19, 20; y 1971: 269ss., nota 18.

12 Para una descripción detallada de esta fiesta basada en las fuentes, véase Broda 1971: 282-98 y Ms.c.

13 Para esta interpretación del simbolismo de la fiesta actual de Santa Cruz, me baso en datos de la región nahua de Guerrero, provenientes de Citlala, Ostotempa (Olivera 1979; también Sepúlveda 1973 y Suárez 1978) y Ameyaltepec (observación propia, 2 de mayo 1980).

14 Los datos de San Mateo Huexoyucan, Tlaxcala, proceden de las notas de campo de Jon Ander Bilbao, 1978-79 (Ms.). Quisiera expresar mi agradecimiento a Bilbao, profundo conocedor de la ecología y la agricultura tradicional de esta región del altiplano, por sus valiosas informaciones así como por sus comentarios a mi trabajo.

15 Información proporcionada por J.A. Bilbao (Ms.).

16 Para una descripción detallada de estos ritos, véanse Broda 1971: 301-312, y 1979. En aquellos trabajos analizo también la participación de los grupos sociales en estas fiestas.

17 Información proporcionada por J.A. Bilbao.

18 San Mateo Huexoyucan, notas de campo de J.A. Bilbao (Ms.).

19 Molina 1970; Carrasco 1979: 53.

20 Cfr. Broda Ms.a. En cuanto a la iconografía de Tlaloc como Sol Nocturno, cfr. Pasztory 1974 y Klein 1980.

21 Mientras que el ciclo de cultivo de temporal empezaba a fines de la estación seca y se prolongaba a través de la estación de lluvias para terminar con las cosechas a principios de la época llamada tonalco; el ciclo del cultivo de riego pertenecía exclusivamente a esta última parte del año. Es de notar que los cultivos de humedad se suelen llamar hasta hoy en día, tonamil, "milpas de estío" (Cfr. Carrasco 1979: 56). Además, el maíz de regadío se llama tonalcentli, según indica Molina.

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CF, véase Sahagún.

CFN Calendario de Francisco de las Navas

Calendario de fray Francisco de las Navas, de D. Antonio de Guevara y Anónimo Tlaxcalteca. Colección Antigua del Museo Nacional de Antropología e Historia, 210. (Colección Ramírez: Opúsculos Históricos, 21). México: Museo Nacional de Antropología e Historia, págs. 93-203. (Ms.)

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GORDON BROTHERSTON

The Year 3113 BC and the Fifth Sun of Mesoamerica: an orthodox reading of the Tepexic Annals (Codex Vindobonensis obverse).

The claim announced in this title is that the Goodman-Martínez-Thompson base date of 3113 BC[1] (3114 BC for historians) extends beyond the tun calendar and hieroglyphics of the Maya lowlands, being likewise observed in texts written in the "Mixtec-Aztec" or iconographic script of Mesoamerica; and that as the year "13 Reed" engraved on the Aztec Sunstone it begins a 5200-year span equivalent to the 5200-tun Era of the lowland Maya (Plate 1). Furthering the argument set out in A Key to the Mesoamerican Reckoning of Time (Brotherston 1982) and "Astronomical Norms in Mesoamerican Time-Reckoning" (Brotherston 1982a), the paper concentrates on the Vindobonensis obverse and related iconographic texts which Caso and Nowotny have attributed as a group to northwest Oaxaca and the upper Papaloapan drainage, the area named Anahuac in the Cuauhtitlan Annals (cf. years 1064 and 1446 AD) and in the Florentine Codex Book 10. A means is found of correlating these texts with those of Tenochtitlan and Tilantongo, and with certain hieroglyphic narratives, which reveals their base-date to be 13 Reed 3113 BC. This remarkable time span is spelt out by successive year dates in the Vindobonensis while elsewhere it is covered by means of year multiples, chiefly the 52-year (Calendar) Round and the 400-year tzontli or "Head". Our capacity to read year-narratives in general is much improved with the proper recognition of how such multiples function iconographically.

Throughout, with its characteristic solar design (originally the Rain-god's headdress at Monte Alban) and with its Number-plus-Series Sign (Fig. 2a), the year in question is taken to be the seasonal period of agricultural tribute, i.e. to be of 18 weeks or "Fasts" of 20 days plus epagomenal days, not the unvarying or metric 365-day year of the hieroglyphic inscriptions. This last point has been argued separately, on several counts, which tie in with proofs set out elsewhere in this volume by Broda, Tichy and others (Brotherston 1982: 9-16).[2]

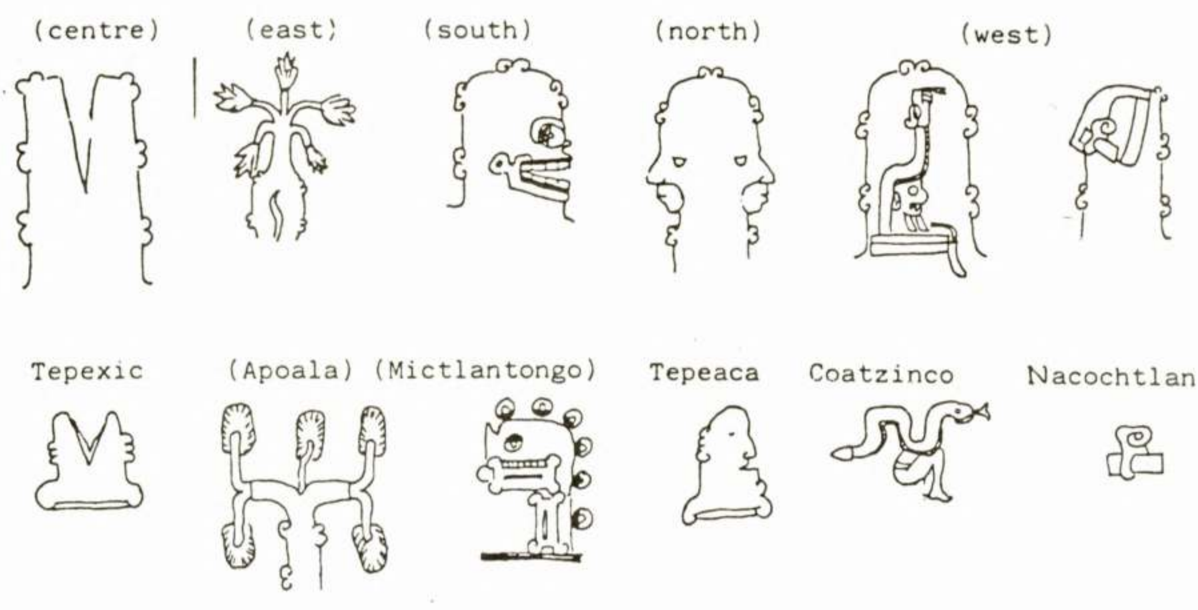
The Anahuac tradition

Some of the later studies completed by Alfonso Caso (1954, 1958, 1961, 1964) focused on the toponyms, events and rulers common to the "lienzos" or Maps of Ihuitlan, Tlalpitepec (Antonio de León), Coixtlahuaca and other towns in the Anahuac area. Showing the parallels between them, he further related them to the Selden Roll, the Gómez de Orozco fragment, the Baranda Codex and above all the Vindobonensis screenfold (obverse). While indicating

Fig. 1 Tepexic and surrounding towns

a Map

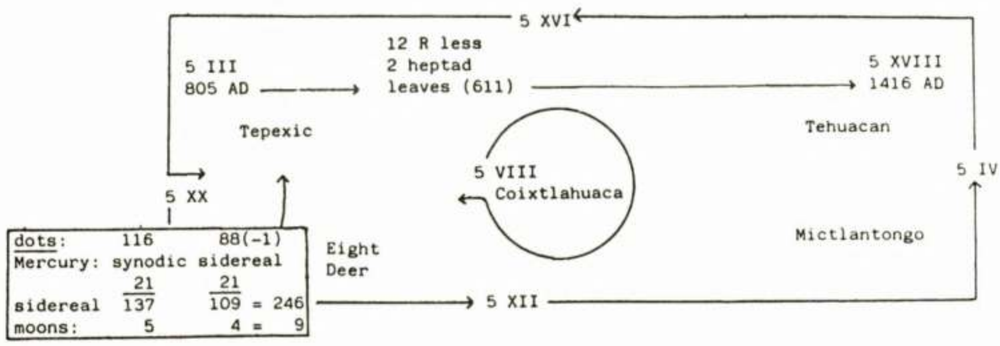
b Toponyms in native script



Upper row: Tepexic Annals pp.32, 35, 39, 43, 48; lower row: Mendoza p.42, Tilantongo Annals p.15, Selden p.6.

Fig. 1 Tepexic and surrounding towns

c Diagram of Aubin ms 20



d Tribute-town ciphers

Tepexic

head-towns		all towns
centre	6	
east	7	88
south	5	21
north	12	116
west	5	21
	29	246

Tilantongo

head-towns	
centre	2
west	5
south	6
north	11
east	7
	29

Tenochtitlan

gobernadores		head-towns		all towns										
Petlacalcatl	123	centre	9	13	10	26	16	26	7	10	7	9	=	124
Atotonilco	46	west	7	6	7	13	12	6	2	1			=	47
Tlachco	69	south	7	10	14	12	13	8	6	6			=	70
Chalco	82	east	7	6	22	11	11	3	22	8			=	83
Cuauhtochco	45	north	8	7	6	7	11	7	2	5	1		=	46
	365		29											246

Tepexic A pp.32,35,39,43,48; Aubin ms 20. Zouche reverse pp.12-27.
Mendoza pp.22-55

a relative time-depth for such figures as Four Alligator, Four Jaguar and Two Dog,[3] which appear in these sources, Caso nonetheless mostly refrained from translating into the Christian calendar the Series III year-dates attaching to them, intimating rather that these texts might have to be dated en bloc, possibly via a hitherto unnoticed correlation between Mesoamerican and Christian years.

To this degree uncontentious and accepted, this work by Caso on the Anahuac texts has completed studies by Nowotny, notably his commentary on the Vindobonensis (1948) and his Tlacuilolli (1961). Remarking on the toponym sequence common to the Vindobonensis, the Aubin ms 20, and the Series II annals of nearby Cuicatlan (Codex Porfirio Díaz), Nowotny interpreted it in terms of a historical self-validation on the part of the ruling class and priesthood of that area. Giving advice unfortunately ignored by such recent commentators as Jill Furst in her basically synchronic reading of the Vindobonensis (1978), Nowotny stressed that however ritualized and to that extent "mythic" the events depicted in some of the Anahuac texts might appear they should nonetheless be recognized to have a firm basis in economic and material history, this history being of considerable length and cosmic in its beginnings. The historicity of the Vindobonensis has now been further vindicated by Melgarejo Vivanco (1980), who reveals its connections not just with the "Mixtec" capital Tilantongo but with the Gulf Coast, via the Papaloapan. Also, in transcribing the Vindobonensis obverse dates Melgarejo Vivanco uses the Tenochtitlan correlation rather than the Tilantongo correlation known to be valid for the genealogy on the reverse of the same screenfold.

Continuing this approach to the Anahuac group of texts we may in the first instance further explore their geography. A main aid to this end are the sets of toponyms which accompany five of the ten fire-kindlings reported in the Vindobonensis, for they clearly represent a tribute arrangement of head-towns (cabeceras) in the centre and the four surrounding "fields" or quarters (pp. 32, 35, 39, 43 and 48; cf. Fig. 3a). The same standard arrangement is found for Tenochtitlan in the Mendoza and for Tilantongo in the Zouche (reverse pp. 54-68), where moreover the total of the cabeceras is conventionally made to equal the lunar cipher 29, exactly the Vindobonensis total: in "ritual" texts like the Féjérváry map (p. 1) and the Borgia tribute sequence (pp. 49-52), this same total is esoterically achieved by means of four Quecholli or feeding birds, one to each quarter with its characteristic tree.[4] The consistency of the Vindobonensis with this convention and its overlap in detail with the alphabetically-glossed toponyms and tribute commodities in the Mendoza, and with other sources like the Tilantongo Annals (Zouche obverse) and the Selden, enable us surely to identify its central toponym as Tepexic and hence to name the 52-page text the "Tepexic Annals" (Fig. 1). In this reading not only the cabecera towns in the centre and the four tribute fields fall into place but so does their respective tribute: Tepexic with its cane-work (p. 32); Apoala in the east, the source of cacao (p. 35); Mictlantongo to the south, the shrine of lady Nine Tooth (p. 39); Tepeaca with its high mountains to the north (p. 43); and Nacochtlan and Coatzinco to the west (p. 48).

Such a geographical arrangement is further confirmed by, and itself confirms, that found in other Anahuac texts. In Aubín ms 20 (Culte rendu au soleil), whose effaced central toponym may fairly be reconstructed as Coixtlahuaca, Tepexic stands appropriately to the northeast (top left) opposite what is possibly Tehuacan (top right); below we again find Mictlantongo, to the southeast (bottom right), matched with a toponym whose designation "Eight Deer Defeated" must point to Tilantongo, in the southwest (bottom left; Fig. 1c). Succinct in conveying what appears to be the literal dominance of Tepexic over Tilantongo, the Aubin ms 20 might in fact be more informatively referred to as the "Anahuac Map". Finally, in the case of the Selden Roll there seems to be no reason not to read its terminal toponym as "Ihuitlan", given its resemblance to other versions of that town's glyph; standing on the line between Tepexic and Coixtlahuaca, this place is the scene of a fire-kindling orchestrated by the character Two Dog, also featured at a near-contemporary kindling in the Tepexic Annals (p. 43; Fig. 3a, 6c).

Thus integrating the Tepexic Annals more fully into the Anahuac group of texts on firmly geographical and economic terms opens the way to a better understanding of just that material history insisted upon by Nowotny and Caso, in contradistinction to idealist and synchronic readings in the style of the structuralists. Indeed the 180 year dates recorded successively, in boustrophedon, over the 52 pages of these annals may for the first time be acknowledged for what they are: <u>moments in sequential time</u>. They may be accepted as no different from exactly analogous dates found in texts of identical format (cf. Plate 10) like the genealogy on the Vindobonensis reverse, or the obverse and reverse of the Zouche (here called the "Tilantongo Annals" and the "Bachelorhood of Eight Deer") whose historicity has never been doubted.

Year correlations

Still in its infancy, the whole question of correlating Mesoamerican annals or year-calendar texts has been hampered from the start by two prejudices. Instead of allowing for even the notion of self-awareness on the part of native scribes and historians, within the iconographic script tradition which they share, too often we have isolated this or that local convention of style attempting to match it <u>seriatim</u> with the Christian calendar. Then, instead of respecting the integrity of native sources, especially those that have survived in iconographic script, we have deferred to the often partial view of the conquering Spanish. The case for the several Series III correlations proposed by Kirchhoff and Davies (1977) would undoubtedly be stronger if it allowed more for the idea of native calendrical competence.

So far, only three correlations between Mesoamerican and Christian years can be accepted as firm, all three having been decoded from native script. One, in Series II, is restricted to Tlapa and the few texts extant from that area (cf. Toscano 1943). The other two are both major Series III correlations: the one involves large areas of the Aztec empire centred on Tenochtitlan;

Fig. 2 Year Series and correlations

a The Twenty Signs arranged in the five year Series I to V

I	Alligator	VI	Death	XI	Monkey	XVI	Vulture
II	Wind	VII	Deer	XII	Tooth	XVII	Quake
III	House	VIII	Rabbit	XIII	Reed	XVIII	Flint
IV	Lizard	IX	Water	XIV	Jaguar	XIX	Rain
V	Snake	X	Dog	XV	Eagle	XX	Flower

b Progress through the year Series I to V (Borgia pp.39-40)

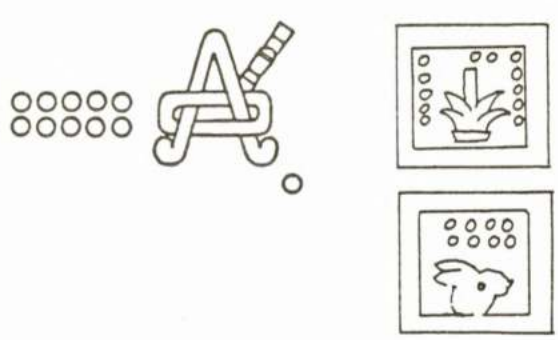
		XI	XVI
I	VI	XI	XVI
I	VI	XII	XVII
II	VII	XII	XVII
II	VII	XIII	XVIII
III	VIII	XIII	XVIII
III	VIII	XIV	XIX
IV	IX	XIV	XIX
IV	IX	XV	XX
V	X		

c Sample correlations of Reed years

	C:C	Sign Nos.		AD	Source
a	1:10	XIII	1:10	1035	Tlalpitepec Map
b	1:11	XIII	6: 3	1339	Tepexic Annals p.49
c	10: 1	XIII	9:13	1047	Zouche reverse p.35
d	11: 1	XIII	9:12	1423	Rios p.106
e	11:10	XIII	7: 6	1499	Acuecuexatl Stone
f	11:12	XIII	11:12	1347	Cuauhtitlan Annals f.24
g	12:11	XIII	3: 2	1455	Huichapan Annals p.29

a e directly equate the two year names, expected and alien;
d f g interject the alien name; b c invoke it (the Chichimec New Fire year at Cholula, and the Era year, respectively).

d Two correlations involving Series III C1



1 Reed twinned with 10 Reed 1035 AD, Tlalpitepec M;
9 Reed ousted by 12 Reed 1423 AD, Rios

the other Tilantongo, Nahua-speaking Tecamachalco, and "Colhua" Texcoco. According to the former correlation, 1516 AD was a year 11 Flint, in the Round of 52 years; according to the latter 1516 AD was a year 10 Flint (cf. Caso 1967; Jiménez Moreno 1940). For convenience they are referred to here as Series III "C11" and "C10" respectively, after the example quoted. At the same time it is clear that these were not the sole correlations to have existed, if only because others can be seen to be alluded to if not decoded in such texts as the Vindobonensis reverse (p. 6), the famous gold pendant from Monte Albán analysed by Caso, and several stelae at Xochicalco. In the first case an aberrant year Sign (13 Owl) intrudes into an otherwise regular sequence of Series III dates, whose equivalent value in Series III can by that token be numerically deduced (13 House); this might be termed an "ousting" device, with an unexpected year-date replacing the expected one. In the second case, on the Pendant (cf. Caso 1960: 35), Series II and Series III years are equated through the anatomical image of lungs breathing in time with each other, 10 Wind with 11 House; this might be termed a "twinning" device. In these matchings between local varieties of the Mesoamerican year calendar, the years substantially referred to matter less for the moment than the fact that they exist, as <u>internal</u> correlations, in native script, and that they exemplify two distinct yet readily understandable principles of correlation, "ousting" and "twinning".

Taking into account the considerable range of year-calendar texts in native script and their alphabetic transcriptions and glosses in Nahua (occasionally Otomi), the following appears to be the case. Several other aberrant year dates, dismissed hitherto as consequences of the "scribal error" we so freely attribute to native America, can more appropriately be read as examples of the ousting and twinning noted above, and hence as further examples of internal year correlations. These have been discussed at length elsewhere (Brotherston 1982: 17-20). Within Series III, they either confirm the existing C11 and C10, as in the twinning of 7 Reed with 6 Reed (1499 AD) on the Acuecuexatl Stone and the ousting of 13 Rabbit by 12 Rabbit (1414 AD) in the Xolotl Maps (cf. Dibble 1951: 119); or they suggest two further correlations equivalent to C1 and C12, i.e. 1516 AD as 1 Flint or 12 Flint (Fig. 2c). Most important, in all cases these correlations reinforce each other reciprocally, while being confined to just these four possibilities in Series III: C1, C10, C11 and C12; and all four are distinguished by the fact that they retain the same Sign for a given year (e.g. Flint) while changing the qualifying number (1, 10, 11 and 12), a "rule" independently established by Davies.

Four is the limit of the great "usages" of power (ueue tlamanitilztli, ueue tlatolloyan) acknowledged by Tenochtitlan: Toltec, Chichimec, Colhua and Tepanec (Lehmann 1949: 105), an arrangement echoed in Chimalpahin's <u>Memorial breve</u>. Two of these readily correspond to two of the four calendrical correlations identified above: C11 as Chichimec, and C10 as Colhua. Good reasons for identifying the C12 convention with the Tepanec, who do not immediately concern us here, can be found in the ousting of Chichimec or Aztec C11 years by C12 years in texts from the Tepanec area, like the Huichapan Annals (1455 as 3 Reed rather than 2 Reed)

and the Techialoyan Books of Mimiahuapan and Tizayuca (1544 and 1596 as 1 Flint rather than 13 Flint), and in the Cuauhtitlan Annals, with reference to the Tepanec hero Tezozomoc (1347 as 12 Reed rather than 11 Reed). This leaves, then, only one of the four correlations in question, C1, and the possibility of its being thought "Toltec" and hence older and more august than the other three.

Clear examples of internal correlations between Chichimec C11 and "Toltec" C1 years occur in the Cuauhtinchan History where 3 Reed ousts 13 Reed (1427 AD), in Ríos where 12 Reed ousts 9 Reed (1423 AD; Fig. 2d), and on the Moctezuma Stone which twins 4 Rabbit with 1 Rabbit (1506 AD). In the Cuauhtinchan History the concern to reconcile Toltec with Chichimec usage is announced in the very subtitle of the work, "Historia tolteca-chichimeca"; and in Ríos concern with the ancient Toltecs and their tradition is quite evident in the opening chapter, which is strikingly absent from the closely-related Telleriano Remensis version of the same Chichimec history, along with the 1423 AD 12 Reed equals 9 Reed correlation. The same respect for a venerable "Toltec" antecedent to the Chichimecs and Aztecs seems implicit in yet other C11 texts insofar as they spell out the 16-year gap which formally separates their own from C1 year names in the 52-year Round (e.g. in C1 1 Flint equals 1516; in C11 it equals 1532). This gap is accounted for in the pair of Nepopualco Maps, the one invoking the first Round year 1 Flint in C1 as 632 AD and the other invoking it in C11 as 648 AD (see below and Plate 5); it appears also on the Mendoza title page, between the 51 named years around the margin (1325-1375 AD) and the 67 year-leaves in the quarters (i.e. 1309-1375 AD) which themselves incorporate the toponym Tula or Toltec (Plate 3). For their part the Cuauhtitlan Annals offer to locate this Toltec tradition in Anahuac since in exalting Coixtlahuaca as the capital of that region and the key to the whole tribute wealth of the east they identify its dynasty as both ancient and Toltec; even more straightforwardly the Cuauhtinchan History announces the area as _the_ Toltec enclave.

If the "Toltec" C1 correlation revealed in the Cuauhtinchan History and Ríos is in fact applied to the Anahuac group of texts then it can immediately be confirmed as correct, both by reciprocal correlation devices within the Mesoamerican system and through translation into dates AD. In describing the conquests of Four Jaguar, the Tlalpitepec Map twins its own year name for 1035 AD, 1 Reed in C1, with the name for the same year in Tilantongo's C10, i.e. 10 Reed (Fig. 2d); the significance of this can be deduced from the Tilantongo texts, the "Bachelorhood of Eight Deer" for instance, which shows the intense military and political contact between this hero and Anahuac's Four Jaguar at just this period (Zouche pp. 52-79, 1045-47 AD), _pace_ Smith (1973: 74, 124), who fancies Four Jaguar never existed. For its part the Baranda Codex, associated by Caso with the Anahuac group, also corroborates the validity of C1. For if read in that correlation it ends devoutly with the 16th Christian century, to the year (6 Flint or 1600); and in the year 1 House or 1529 it shows a church and Cortés coming to terms with a native leader whom an 18th-century native interpreter firmly identified as Cosiobi of Tehuantepec, of the Zapotec line driven from Zaachila by the Mixtecs (Caso 1958). It

was in that very year that the Dominicans began work in Oaxaca and that Cortés became Marquis of the Valley, taking the royal line from Cosiobi on the death of Cosiobi's father Cosihuesa.

Applying the "Toltec" C1 to the Anahuac texts makes possible an extended chronological comparison between them, an essential counterpart to the complex genealogical sequences that they contain; and between them and the other two major Series III traditions, of Tilantongo and Tenochtitlan. This work would continue that of Caso and Nowotny, enhancing our overall view of the Mesoamerican year calendar. Above all it enables us further to link this last with the Maya tun calendar, with which it otherwise has so much in common, in nomenclature, structure and sheer mechanics. For it is generally agreed that in the tun calendar the Era lasts 5200 tuns and has its start date in the year 3113 BC. Though little has been made of the fact, in the year calendar the Era is clearly stated to be 5200 years in length (Ríos p. 8; cf. also the 2088 AD or 5200-year date in the Tizimin, Edmonson 1982: 197),[5] while the Series III year with which it begins is just as clearly stated to be 13 Reed (Cuauhtitlan Annals; Aztec Sunstone, Plate 1). In the Toltec C1, working back through the centuries, 3113 BC is in fact a year 13 Reed (which of course it therefore could never be in other Series III correlations like C10 or C11); at the same time Tula, from which the term Toltec derives, stands as the inaugural city of Mesoamerica everywhere associated with the beginnings of the of the 5200-year Era span (cf. Brotherston 1983). Indeed "Toltec" or C1 texts like the Tepexic Annals can be shown to narrate an Era history exactly commensurate with that found in the tun texts of the lowland Maya.

Time depth

If the Tepexic Annals are read continuously from end to end, strictly according to the norms that pertain to the boustrophedon narratives of Mesoamerica, then there is no way that they can be seen not to cover several thousand years (Fig. 3b). Opening with a well-known formula which integrates the tonalpoualli with the year (7 x 260 = 5 x 365 less 5 days) and which here issues into the first year date, 5 Flint (p. 3), the first chapter alone covers 3451 years, culminating the fire-kindling in the year 6 Rabbit (p. 21). One single irregularity in the boustrophedon reading occurs on p. 6 where the reading stream divides, the upper part covering two Rounds less than the lower; these however are supplied by the upper tributary stream from the previous page. Similarly, the narrative continues quite regularly through the remaining nine chapters and fire-kindlings, over a further thousand years. Then, after the tenth and final kindling, the reading stream is fully blocked or staunched by a unique 2 House date inset into what will later be shown to be a commemorative marker of year multiples (14 Rounds; p. 50). This suggests that the remaining dates in the text project into the future, in the fashion of certain tun narratives. Arithmetically, this additional span, of 331 years, has the effect of completing the calendrically significant overall total of 4800 years, from the first year date 5 Flint to the last, 8 Flint.

Fig. 3 Analysis of the Tepexic Annals

a Overview of the ten chapters (R = Round)

Page:	
1-22	chapter 1
1	womb of heaven with four pairs each representative of a Sun in descending order of time
2-3	ancestral and troglodyte pairs bearing day dates from 1 Deer 30 March 3113 BC to the first named year 5 Flint 3108 BC
4-6	'Beget and bear' birth sequence of Nine Wind, his descent between sun and moon, and his raising of the sky in 10 House R5, 2843 BC
7-15	toponym history of the early period 5 House R8 to 13 Rabbit R60 (2679 BC to 46 AD)
15-18	Tree-birth presided over by Nine Wind; appearance of bald- and egg-head pair, Ten Death, Eight Wind etc.
19-22	1st or 'Classic' kindling, by Nine Wind 6 Rabbit R66, 338 AD
23-32	chapter 2
23-26	preview of kindlers
27-29	luxuries of maize, pulque and mushrooms R68-70 (cf. topics 2-4 in Palenque Trilogy panel 1, 8.19.0 to 9.0.0.)
29-30	'hiatus' and restoration, R71-R73, 6th-7th centuries AD
31	start of 'dropped leap day' sequence R74 to R79
31-32	2nd kindling, at Tepexic with its cane-work tribute; by Two Dog Jaguar Claw, in 5 House R75, 805 AD
33-39	chapters 3-6
33-34	3rd kindling, 13 Rabbit R75, 826 AD
35-36	4th kindling, 7 Flint R76, 872 AD, by Xolotl. Eastern quarter, seven toponyms inc. Apoala; cocoa tribute
36-38	5th kindling, 5 House R77, 909 AD
38-39	6th kindling, 1 Reed R77, 931 AD. Southern quarter, five toponyms inc. Mictlantongo, with lady Nine Grass
40-52	chapters 7-10 (kindlings measured as Rounds)
40-41	7th kindling, 7 Reed R79, 1015 AD, with Four Alligator
41-42	8th kindling, 5 Flint R81, 1104 AD
43-47	9th kindling, 7 Reed R82, 1171 AD, with Two Dog. Northern quarter, twelve toponyms inc. ?Tepeaca
48-52	10th kindling (drill unused), 5 House R84, 1273 AD. Western quarter, five toponyms inc. Nacochtlan, Coatzinco, ?Tepexochocan
49	Eagle and Jaguar warriors at Venus temple 6 Reed-6 Reed, 1287-1339 AD
50	boustrophedon reading flow staunched at 2 House 1361 AD, the likely date of composition, in R86, 14 Rounds (mouths) from R72 and before R100
52	final projected date 8 Flint R92, 1692 AD, exactly 4800 years or 12 Heads from 3108 BC (p.3).

Fig. 3 Analysis of the Tepexic Annals

b Transcription of the year-date sequence

(2) 1 VII 1 VII 1 II 7 II 12 II 13 II 4 V 7 V 4 I 11 II
(30 March 3113 BC)

(3)	7 XIX	7 XV	5 XVIII		0.5	0.42	1.39	(4)	1.40	2.18	3.10	4.10	
				BC	3108	2971	2922		2921	2891	2847	2895	
				5.21	(5)	6.19	7.19						
				2832		2782	2730						
(6)	4.19	5.10		5.49	6.5	6.20	7.5		7.44				
	2886	2843		2804	2796	2781	2744		2705				
(7)	8.18	8.20	8.35	8.40	9.18	9.35	9.37	9.43	10.17	10.20			
	2679	2677	2662	2657	2627	2610	2608	2602	2576	2573			
(8)	10.39	10.40	11.39	12.34	12.39	13.16	14.16	14.40	15.35	16.27	16.42	17.20	18.19
	2554	2503	2502	2455	2450	2421	2369	2345	2298	2254	2239	2209	2158
(9)	18.25	19.10	19.41	20.16	20.32	20.44	21.36	22.20	22.25	23.20	23.40	24.40	
	2152	2115	2084	2057	2031	2029	1985	1949	1944	1897	1877	1825	
(10)	25.40	25.42	26.40	27.4	27.20	27.28	28.20	29.18	29.39	30.5	30.18	30.40	31.27
	1773	1771	1721	1705	1689	1681	1637	1587	1566	1548	1535	1513	1474
(11)	32.11	32.20	32.27	33.4	33.27	33.33	34.27	35.10	35.20	36.10	36.47	37.47	
	1438	1429	1422	1393	1370	1364	1318	1283	1273	1231	1194	1142	
(12)	38.8	38.19	39.6	39.28	40.25	40.33	40.40	41.11	41.43	42.6	42.8	42.40	
	1129	1118	1079	1057	1008	1000	993	970	938	923	921	889	
(13)	43.20	44.20	44.39	45.8	45.34	46.8	46.20	46.43	47.34	47.40	48.8	48.17	48.28
	857	805	786	765	739	713	701	678	635	629	609	600	589
(14)	49.20	49.45	49.46	50.21	51.8	51.20	51.40	52.40	53.20	54.5	55.5	55.40	56.20
	545	520	519	492	453	441	421	369	337	300	248	213	181
(15)	57.18	57.28	57.35	58.20	58.21	59.21	59.39		60.39	(18)	61.39	62.21	62.35
	131	121	114	77	76	24	6	AD	46		98	132	146
(20)	63.10	63.39	64.20	64.39	(21)	65.39	66.19	(23)	66.35	66.39	66.44		
	173	202	235	254		306	338		354	358	363		
(26)	67.42	68.35	68.39	68.44	(28)	69.35	(29)	70.8	71.5	72.5	(30)	73.5	73.39
	413	458	462	467		510		535	584	636		688	722
(31)	74.39	(32)	75.18	(33)	75.34	(34)	75.39	(35)	76.16	76.33	(36)	76.49	
	774		805		821		826		855	872		888	
(37)	77.18	(38)	77.35	(39)	77.40	(40)	78.20	(41)	79.20	80.5	(42)	81.5	
	909		926		931		963		1015	1052		1104	
(43)	81.20	82.20	82.40	(48)	83.18	84.18	(49)	84.32	85.32	85.36	85.40		
	1119	1171	1191		1221	1273		1287	1339	1343	1347		
(50)	86.2	86.40	87.10	87.40	(51)	88.33	89.18	89.27	90.4				
	1361	1399	1421	1451		1496	1534	1543	1572				
(52)	90.27	90.47	91.39	92.21									
	1595	1615	1659	1692									

(2) etc. = page number
1 VII etc. = opening day sequence (= 7 x 260 = 5 x 365 less 5 days)
0.5 etc. = Round in the Era and year in the Round with 1 Flint as the first year of the Round

Fig. 3 Analysis of the Tepexic Annals

c Ritually significant data

Total of pages:
52, years of the Round

Total of year-dates used:
180, days between the equinoxes (9x20)

Total of toponyms in the quarters:
29, nights in the moon

Maxima of year-dates per page:
12 or 13, moons in the year

Overall year span:
4800, 12/13 of the Era

Maxima of year-dates used within the Round, by Series Sign:
7, orifices of the head, Signs House and Rabbit
9, orifices of the body, Signs Reed and Flint
32, teeth, all Signs, i.e. 2(7+9)
20, digits, unused, i.e. 52 - 2(7+9); cf. the Cospi formula (pp.1-8): $5 \times 52 = 2(7^2 + 9^2)$.

Most frequently used dates:
7 Reed (0.20), the 20-year Flag within the Round; designated by mouth markers over 5-Round intervals at Rounds 17, 22, 27 and 32 (13x20=260=5x52).
1 Reed (0.40), the 40-year Cross Eagle or active life within the Round, as with the heroes One Reed and Eight Deer; designated by mouth markers over a 10-Round interval at Rounds 14 and 24 (13x40=520=10x52)

Decimal features:
10 chapters
10 kindlings
10 characters named Two Dog (Sign X)

Dominant Round interval, of nine Rounds, marked by a) the year-and-day date 2 Reed 2 Reed and b) Hero 9 (Quetzal-snake Nine Wind):
a) at Round 27 or 9x3 Rounds (27.28, the sidereal-year span) at Rounds 39, 48 and 57
b) at Rounds 66, 75 and 84 (kindlings 1, 2 and 10).

This considerable time depth has never been fully acknowledged in the Tepexic Annals. For his part Nowotny contrived to deny it by suggesting that though historical in origin the year dates given had been absorbed into "timeless" ritual patterns; in addition, he dispensed altogether with pp. 6-15 of chapter 1. These pages, which alone cover over 52 Rounds (52 x 52 years), he demotes to being a subsection (Unterabschnitt), a recapitulation of the narrative before and afterwards ("Rekapitulation der ganzen Bilderfolge ... vor und nach"; 1961: 47, 256). On formal and all other grounds there is absolutely no justification for treating the narrative in this way: the pages in question are wholly continuous with the general reading stream and not separated off at all, so that the very use of the term (Unter)abschnitt or "cut" is technically incorrect.[6] Formally speaking, there is no orthodox alternative to the thousands of years sketched out above. It might still be objected that Nowotny could be right in refusing to recognize such a vast time-span in the Tepexic Annals, since it is apparently anomalous among year narratives extant. As a group the C11 texts never start before the mid 7th century AD while the C10 texts, like Ixtlilxochitl's Segunda relación or the Tilantongo Annals, go back only a few centuries before that. Yet this situation is more apparent than real. Far from being anomalous, the Tepexic Annals upon examination provide the key to the Era chronology of the whole year calendar, on the cosmo-historical scale clearly detailed by early commentators like García (1729). This text proves to be the yardstick for the Anahuac C1 tradition generally, other texts in it likewise taking the same early starting date, though counting forward from it by means of year multiples (see below and Figs. 5, 6) rather than by the continuous year dates found in the Annals. And it is the chief guide to the story examined elsewhere (Brotherston 1983) of the great Tula-Nonohualco on the Gulf Coast with its cacao and cotton and rubber and an economic history testified to in a wide variety of sources from west and east Mesoamerica as being long prior to Teotihuacan and to the Chichimec invasions.

To begin with and purely in terms of internal consistency, if the Tepexic narrative is indeed read from the Era date 13 Reed 3113 BC then it yields an excellent self-dating through the ending year 2 House (p. 50). For counted out regularly from the first day-dates in 3113 BC and from the first year date 5 Flint 3108 BC, 86 Rounds are spelt out in the text before this 2 house date is reached, which means it must equal 1361 AD: that is wholly consistent with the dating attributed to the text on other grounds, including the mid-fourteenth century ending of the C10 genealogy on its reverse, already deciphered by Caso. Similarly, counted out from the 3113 BC base the narrative appropriately pinpoints two major figures in Anahuac history, 4 Alligator and 2 Dog, presidents of the seventh and ninth kindlings in 1015 and 1171 AD respectively (pp. 41, 43): these dates, corroborated in other C1 texts discussed below, concord well with the relative time-depth attributed to these figures by Caso (cf. Fig. 3a). Beyond this, when read off from the same Era base, whole sets of date-events in the text may be shown to coincide chronologically with their counterparts in other C1 texts, in other year-calendar texts, and even in tun or hieroglyphic texts, which are known to be commensurate with the Era.

Out of the vast and largely unedited corpus of hieroglyphic inscriptions, texts from Palenque, the Classic Maya city closest to Anahuac, have already suggested certain parallels with the year-calendar tradition. In particular, attention has been drawn to the god-like Nine Wind as a presiding patron in both the Tepexic Annals and the Trilogy of panels at Palenque usually named "Cross", "Sun" and "Foliated Cross" after their central designs. In fact the so-called Cross of the first panel is really an anthropomorphic tree; and beside it to the right a tiny baby-like creature is being regally held (the idea of birth is further suggested by the "Euripos" arrangement of the seven planetary symbols at the base of the tree).[7] This detail is doubly important. It helps to integrate the first panel into the logic of the three and the story of Classic Palenque's origins as it pertains to her ruling elite, her warriors and her maize farmers. And it opens the way to the first dated comparison with the Tepexic Annals version of the same early history (Fig. 4). For on this first panel, standing between the hieroglyphic columns to left and right, the tree scene as a whole is placed by them at about the time of Christ. Counted out year by year from 3113 BC, this is exactly the time of the famous tree-birth in the Tepexic Annals (p. 16), Rounds 59 to 61 of the Era, where supervised by Nine Wind the new-born ruling class actually emerges from an anthropomorphic tree. Similarly, Nine Wind's first kindling in the Tepexic Annals, the climax of the first chapter in the early 4th century AD (6 Rabbit Round 66, 338 AD, p. 21), corresponds to the spread of the hieroglyphic stelae cult in the lowland cities and the start of the Classic. Again, after the much discussed "hiatus" in the hieroglyphic inscriptions in the late 6th century, which is matched chronologically in the Annals by a revolutionary wheel (5 Flint Round 71, 584 AD, p. 29), the Palenque panels celebrate the restoration of order in two successive "split sun" emblems (640 to 690 AD);[8] this same pair of emblems recurs at similar dates in the Annals (636 to 688 AD), being entirely absent from either narrative at any other point (Fig. 4b). Then just as the first kindling pointed to the rise of the Classic and hieroglyphic stelae cult, so the second, at the end of the second chapter (5 House Round 75, 805 AD, p. 32), points to their decline and to the rise of towns like Tepexic, the scene of this kindling, under the auspices of Two Dog Jaguar Claw.

Touching on major events verifiable in turn by archeology, these parallels over almost a millennium strongly bear out the orthodox reading of the Tepexic Annals proposed above, and the notion that its span is indeed commensurate with that of the tun calendar: they certainly could not be explained statistically as coincidence. And they could be further extended, to other hieroglyphic texts, as well as within the Trilogy. For example, the tilth island of Round 14 in the Tepexic Annals recalls similarly dated agricultural glyphs in the Maize panel. Moreover, while once thought "mythical", these remote events are now being shown archeologically to be very much part of the material history of Mesoamerica (cf. Hammond 1982).

Within the year calendar a similar and yet more detailed sequence of parallels may be drawn, in the first instance with the 42-page Tilantongo Annals (Zouche obverse), to which the Tepexic

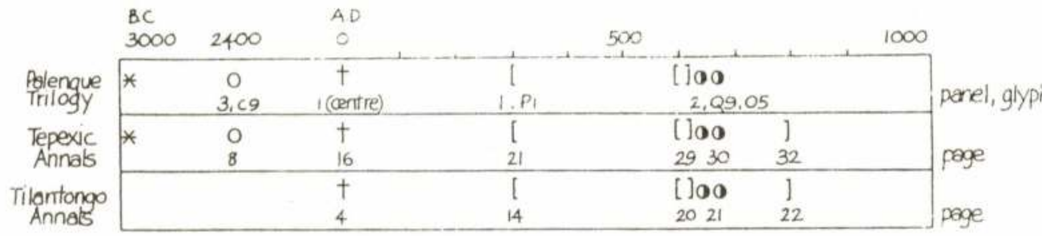
Annals are formally closest among native histories extant. So far translations of this work have mainly focused on the dense genealogy beginning in the year 11 House 789 AD, p. 23, a "new start" which in date and format corresponds to the end of the second chapter and kindling in the Tepexic Annals (805 AD). Read once again strictly according to boustrophedon norms, the earlier pages likewise closely echo those of Tepexic, at least from the time of the tree-birth 15 Rounds previously (Round 60 of the Era). The very first pages of the Tilantongo Annals are admittedly hard to date by orthodox means since the boustrophedon is lacking on the first two (where sequence depends rather on the logic of three successivly more complex methods of raising tribute), while on the third (which records the defeat of the "Stone men") some of the year dates uncharacteristically are devoid of dependent days in the year. After this, however, the reading proceeds normally and the very chapter division reflects that of the Tepexic Annals and hence more broadly the idea of the Classic: the closing date of the first chapter which announces the Classic, 2 Flint 312 AD, in this sense recalls its Tepexic equivalent, 6 Rabbit 338 AD.

Indeed, when they are laid out length for length, the parallels between the Tepexic and Tilantongo histories do no less than leap to the eye (Fig. 4). The first parallel arises from the tree-birth itself at around the time of Christ or Round 60, since at the corresponding moment in the Tilantongo Annals (12 Flint - 6 Rabbit - 13 Rabbit, 16 BC - 30 AD - 50 AD, p. 4), which constitutes the start of the narrative proper in that source, the first born also include an unmistakable and distinctive bald- and egg-head pair (Fig. 4c), along with companions whose names and characteristics are in many cases identical with those given by Tepexic: Ten Death, coloured grey and black; Seven Flower; Eleven Alligator; the lady Eight Monkey, blue in the face; and last in the list Eight Wind with his eagle headdress, to whom Tilantongo devotes a brief biography (5 Flint to 8 Flint, 68 to 112 AD, pp. 5-8). Several of these names appear at the start of the Bodley and other genealogies in the Tilantongo tradition, along with the tree-birth, leaving little doubt that, as Nowotny noted (1961: 257), they belong to the same event as that shown in the Tepexic Annals and that this event indeed marked the beginnings of a powerful and far-flung ruling class. What had been uncertain was the date of the occasion: now, totally orthodox readings of the year-date sequences in the Tepexic and Tilantongo Annals corroborate each other in placing it at the time of Christ, Round 60 (to obtain any other date would mean adopting some sort of <u>un</u>orthodox reading).

In particular, the Tilantongo Annals version of the event helps us to appreciate its complex international nature, something alluded to in such Spanish sorces as Burgoa, and hence the difference in principle between the angles of Tilantongo and Tepexic on what is a whole series of major happenings prior to and throughout the Classic. For celebrated by Tepexic and Palenque alike as the glorious triumph of Nine Wind's cause, the tree-birth is exposed by Tilantongo as the climax of outright and bloody oppression of the possibly Otomanguan Stone-men, whose "fall" is only briefly alluded to in the Tepexic Annals (p. 15). This different view is in keeping with Tilantongo's announcement of the

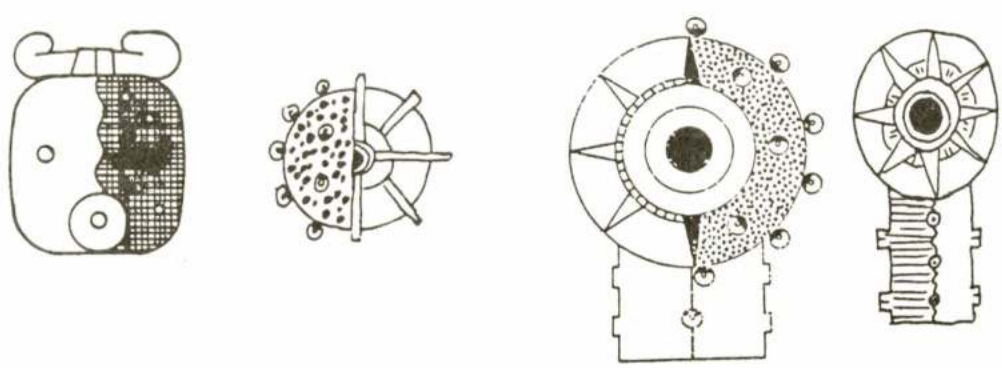
Fig 4 Parallels in accounts of the Classic period

a Overview



* start of the Era, 3113 BC
o maize topic
† tree birth
[start of the Classic
[] hiatus
◐ 'split-sun' emblem
] Classic decline; rise of western dynasties

b The split-sun emblem



Palenque Trilogy   Borgia p.26   Tepexic Annals pp.29-30   Tilantongo Annals p.21

c The bald- and egg-head pair

Tepexic Annals p.16   Tilantongo Annals p.4

Classic, three centuries later, not as Nine Wind's achievement alone but the result of a triple alliance of which the same Stone-men constitute one party (2 Reed - 2 Flint, 299 - 312 AD, pp. 11-13); and it concords too with the attention paid prior to the hiatus not to Nine Wind in his role as king-maker but to a line of local matriarchs named Three Flint (7 Reed to 5 Reed, 343 - 575 AD, pp. 14-20; cf. Plate 8). And when the hiatus arrives in Round 71 of the Era, late 6th century AD, Tilantongo reveals it plainly to be the result of a massive uprising of the Stone-men, inspired by one of the ladies Three Flint, against Nine Wind's egg-head elite (3 Reed, 599 AD, p. 20): this much expands the mere hint of revolution and unrest given in the Tepexic Annals at the same chronological juncture (5 Flint, 584 AD, p. 29). Moreover with the restoration in Round 72, marked for Tilantongo as for Tepexic and for Palenque by the pair of distinctive "split-sun" emblems which likewise appears only at this point in the entire narrative (12 Flint - 1 Reed, 660 - 675 AD, p. 21; Fig. 4b), we see Nine Wind strutting mercilessly among the corpses of the again defeated Stone-men, who from this point on disappear as a military presence. Overall, there can be little doubt about this continuity of echoes not just between the Tepexic Annals and the Palenque Trilogy, but between both and the Tilantongo Annals, a fact which further justifies extending the tun base date of 3113 BC to the year calendar, in particular the "Toltec" CI convention of Anahuac.

Turning now to the CII or Chichimec convention, we see that it further corroborates the hypothesis. Here, the most important single parallel stems from the fact that, just as the Round of the tree-birth (60) operates as a kind of secondary base for Tilantongo, so for "Chichimec" towns like Tenochtitlan the restoration of Round 72 (mid 7th century AD) assumes the same function. This is the Round invoked as a base by the Nepopualco Maps, where it is referred to as "yncalco chichimeca" (the Chichimec base; Plate 5); by Chimalpahin's <u>Memorial breve</u> with its start in the year 10 Rabbit 670 AD; by Ixtlilxochtli's <u>Relación sucinta</u>; by the Zacatlan History collected by Torquemada; and by the Cuauhtitlan Annals, which make their start in the year 1 Reed 687 AD and count out every single year between that date and Cortés's arrival in 1 Reed 1519 AD, exactly 16 Rounds (832 years) later. In his day Humboldt (1810: 25) noted how consistently the mid-seventh century was observed as a base date in native texts and referred specifically to the year 648 AD, the first of Round 72 (1 Flint CII). Elsewhere this Round 72 base is invoked as such, in the Era, in counts involving year multiples, discussed below (also cf. Fig. 7). The most esoteric of these year-multiple counts is embedded in the awesome figure who inaugurates the Cuauhitlan Annals and other Chichimec texts: Obsidian Butterfly. For her name may be numerically transcribed as Round 72, from 2 (iztli or obsidian, second of the Nine Figures) plus 70 (papalotl or Butterfly, seventh of the 13 Quecholli, who may carry their number value in lots of ten Rounds).[9] Also we may note a particular parallel between the Chichimec Cuauhtinchan History and the Tepexic Annals in the matter of the ceremonial defeat of Quetzal snake at Cholula over the Round 1287 to 1339 AD (dated 3 Reed CII in the former and, apparently, 6 Reed to 6 Reed CI in the latter, p. 49). A quite special confirmation, however, of the whole Era scheme is provided within

the C11 or Chichimec convention by the Mexicanus of Tenochtitlan, page 9 of which is worth examining in detail, since it openly announces itself as a chronological key (Plate 4).

The dual wheel design on this page juxtaposes Christian with Mesoamerican years. Of the former there are 28 or a solar cycle, identified by the 4 x 7 Sunday or Dominical letters (a - g); of the latter there are 52 or a Round, identified by the Thirteen Numbers and Four Signs of a Series III Round. In the position shown, the "b" year 1558 of the Christian wheel, seventeen years before the "b" year 1575 (glossed as such in arabic numerals, Prem 1978: 275), is just touching the first of the Rabbit years on the Mesoamerican wheel, under the rabbit's nose: in the Tenochtitlan C11 convention 1558 was in fact a year 1 Rabbit, the last of the last Aztec fire-kindling Rounds completed before the Mexicanus was written.[10] Hence, the wheels not only are juxtaposed but mesh. In the centre of the Christian wheel St Peter holds a triple-pronged key in his right hand and in his left a book on whose pages five units (dots) have been revealed; above his head a cross occupies an extra division of the solar cycle wheel, raising from 28 to 29 the total of the divisions that mesh with the 52 Mesoamerican years, should the wheels be turned further in either direction. In the position given, to alter or break the Christian cycle in this way seems to point to the major calendrical event that occurred shortly after the last letter recorded, "e" or 1578, i.e. the Gregorian Reform of 1582 otherwise alluded to in the Mexicanus, which did effectively cause a break in the 28-year Sunday-letter sequence. At the same time, within the Mesoamerican system this alteration ingeniously points to the reasons behind the Reform in question, that is the imperfect Julian measurement of the seasonal year and hence of the need for leap-year days, insofar as this last was calculated in Mesoamerica according to a formula involving the number 29 (rather than 28). This formula, also found in the tun calendar, specifies that over 29 Rounds or 1508 years the difference between the metric year of 365 days (i.e. without leap-days) and the slightly longer seasonal year itself amounts to a year (Brotherston 1982a: 122): and this is exactly the total of years produced by the operation of the two wheels in question, since 1508 is the lowest common multiple of 29 and 52. Complex enough in itself, this still leaves unexplained the remaining numerical data in the design, viz the three prongs of St Peter's key and the five dots on his book.

In Christian calendrics the 28-year solar cycle has been commonly used to produce larger spans, in conjunction with the Metonic and Indiction periods for example, which gives the Julian Cycle beginning in 4713 BC, or alone, to produce Usher's creation date of 4004 BC (North 1977). Here in the Mexicanus, taking into account St Peter's numerical clues, the emended 29-year cycle can be seen to produce the distance between the start of the first Round of the Mesoamerican Era in 1 Flint (C1) 3112 BC and the end of the last Aztec Round in 1 Rabbit (C11) 1558 AD, thus linking and confirming the two separate decodings, of date and cycle, made so far. For fully turned thrice through all combinations, as the lock imagery of the key suggests that they should be, the wheels

produce 4524 or 3 x 1508 years and the date 1412 AD, to which may then be added five turns of the Christian wheel or 145 years, the interval to the goal of 1558 AD. On the Aztec side this subsidiary total is equivalent to the interval (exclusive) from 1 Flint C1 1412 AD to 1 Flint C11 1428 AD, plus two Rounds or 104 years to 1 Flint 1532 AD, plus the half-Round or 26 years to 1 Rabbit 1558 AD. If novel, this reading of Mexicanus p. 9 violates none of the rules of Mesoamerican calendrics and accounts satisfactorily for all the numerical data supplied in the text.

Along with the evidence from Palenque and Tilantongo, this apparent Era chronology in a text from Tenochtitlan strengthens the argument that the 13 Reed on the Aztec Sunstone is indeed 3113 BC and the start date of the Tepexic Annals. As a result, the Toltec C1 convention observed in those Annals offers a unique means of interlocking the firmest of the calendrical correlations so far made, independently of each other, in Mesoamerican studies. These are the 3113 BC base established for the tun calendar by Thompson; the Tilantongo Series III C10 proposed by Caso; and the Tenochtitlan Series III C11 known since Cortés. This evidence becomes stronger again once the function of year multiples in the Mesoamerican calendar is examined and taken into account.

Year multiples and time-structuring

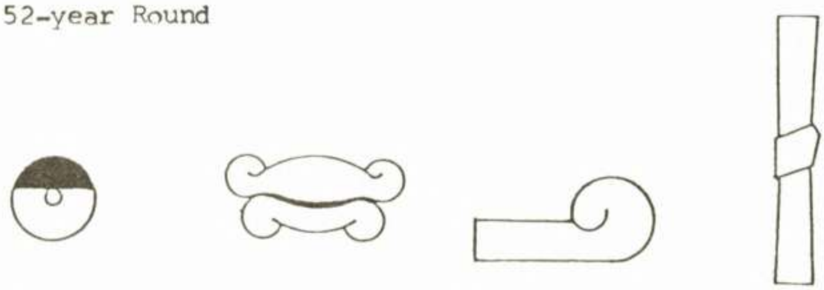
Counting out time by means of year multiples may be deemed fundamental to the very notion of the Mesoamerican year calendar, such multiples being of three main kinds. The first derives from tribute arithmetic and includes the 400-year tzontli (Head) or ihuitl (Feather) along with such factors of the Head as the 20-year pantli (Flag); in the tun calendar these have obvious analogies with the 400-tun baktun and the 20-tun katun. The second derives from the cycles formally produced by the shamanist and ritual mechanisms used to <u>name</u> time, saliently the tonalamatl of 9 Figures, 13 Numbers and 20 Signs, the source of the 52-year Round (13 Numbers x 4 Signs); again an analogy may be found in the tun calendar of the Katun Count (13 Numbers with the katun-ending Sign XX or Ahau). The third, less explored, derives from the sheer measurement of time cycles perceived in earth and sky, independently of tribute or ritual arithmetic, and it includes the 29-Round leap-day cycle noted above, the Metonic "Rain" (Sign XIX) of 19 years, and the 11-year Monkey (Sign XI), also lunar-solar, which equals in years what the epact is in days. Important in principle (Brotherston 1982a), this third kind of multiple does not materially impinge on the argument at this stage, which returns us to the first two (Fig. 5).

While the existence and use of the two main kinds of year multiple, typified by the Head and the Round, stand quite beyond doubt, what is less clear is how many and various such multiples are and, above all, how they are represented in iconographic script (Fig. 5a, b).[11] This unsureness has much hampered the decoding of year-calendar texts. It may be ascribed in part to the nature of iconographic script, which unlike hieroglyphic makes no necessary separation between arithmetic, script and picture. Yet more

Fig. 5 Sources and markers for year multiples

a Tribute arithmetic

b The 52-year Round



c The Nine Figures or Ennead

1 Fire or Year Lord
2 Obsidian
3 Embryo Sun
4 Maize God
5 Hell Lord
6 Jade Skirt
7 Cloth Goddess
8 Hill Heart
9 Rain

d The sevenfold pattern of the Ennead as year guardians beginning with the 1st and 1 Flint; Borbonicus pp.21-2

1	7	5	2	9	6	3
1	7	5	2	8	6	3
1	7	4	2	8	6	3
9	7	4	2	8	5	3
9	7	4	1	8	5	3
9	6	4	1	8	5	3
9	6	4	1	8	5	2
9	6	4				

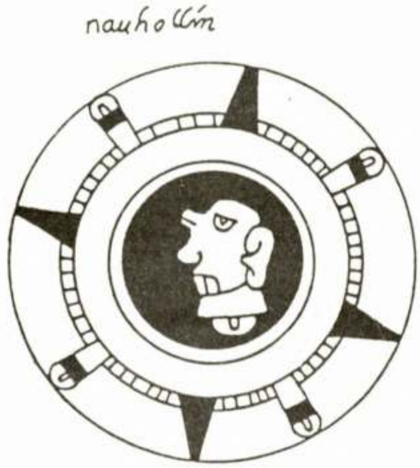
e The thirteen Quecholli or Fliers

1 Hummingbird
2 " (blue)
3 Hawk
4 Quail
5 Eagle
6 Owl
7 Butterfly
8 Eagle (striped)
9 Turkey
10 Eared Owl
11 Macaw
12 Quetzal
13 Parrot

Fig. 6 Examples of year multiples

a Jade, 3 Flint to 5 Flint, 1144-1224 AD; Boturini p.13

b Jade-Round (80 x 52 years), 3113 BC to 1047 AD; Zouche reverse p.35



c Ten Feathers less two stones (10 x 400 less 2 x 4 years), 3113 BC to 1 Reed 879 AD; Ihuitlan Map

d Cross Eagle, 13 Reed to 1 Reed (to 2 Reed), 1219-1259 (-1299); Cuauhtinchan History

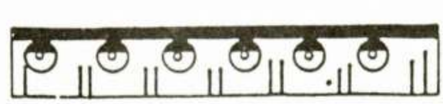
e Three double Round scrolls, 1195-1507; Rios

f Lip Round; Cuauhtinchan History

g Seven Caves; Laud p.21

h Three star-eye Rounds, 1063-ca. 1220; Vienna reverse p.9

i Six star-eye Rounds equated with 66 in bars and dots; Selden p.1



telling has been the lack of the Era framework, with its secondary bases, within which the whole year calendar operates. Also there has been a reluctance to admit much native sophistication outside hieroglyphic in the handling of numbers, when in fact they are repeatedly distinguished, in shamanist fashion, as odd or even, prime or divisible, squared or to the power, as ratios or "sigma" totals (e.g. sigma 5 = 1+2+3+4+5 or 15), and as ciphers by which to shift between dimensions of time (days, years, Rounds) or according to number-base (decimal as well as vigesimal);[12] and all this within and beyond the Era which itself is the lowest common multiple of the Head and the Round (52x100 = 13x400 = 5200).

Often used after Cortés to register lots of 400 years in the Christian calendar, in the native tradition the Head or Feather appears preferentially in the Maps of the Chichimec or C11 convention, like those of Quinatzin, Xolotl, Metlatoyuca and Nepopualco (Plate 5), where two together (800 years) generally point back to the seventh century and the Round 72 base; it is also used in the Tlateloco Annals (Figs. 5a, 7). In the Toltec or C1 convention it is implicit in the 4800-year or 12-Head span of the Tepexic Annals, while in establishing the Toltec beginnings of the Era, Ríos uses the Head to give not just its full length, 13 Heads or 5200 years, but that of previous ages as well. This last example is further notable for bringing out both the importance of ratio in these larger calculations and the flexibility of iconographic script itself, since in Ríos the first instalments of these 400-year periods are shown as actual feathered water drops, forming and falling from the "suckling tree" into the mouths of men still innocent of agriculture - the theme of the chapter as a whole. The overall total thus gained is notionally just under 26000 years, in the following sequence:

$$400(<20,\quad 10 + 10: 12 + 13) \hat{=} 2000(8:5)$$

In other words, if we recall the thirteen Numbers or Quecholli of the tonalamatl (Fig. 5e), we see that this and the previous era bear to each other the lunar "Parrot:Quetzal" ratio 13:12, while together at 10000 years (25 Heads) they bear the Venusian-solar "Eagle:Bald Eagle" ratio 5:8 to the preceding 16000 years (40 Heads). It will also be clear that as the fifth "Sun" of creation this Era thus emerges as a fifth (13 Heads) of the full span or cycle (65 Heads), whose astronomical meaning is touched on below.

Again in the Anahuac tradition and specifically as a Feather (ihuitl), the 400-year period appears to be incorporated into the main toponym of the Ihuitlan Map (Fig. 6c), its ten Feathers giving an appropriate date in the late tenth century AD, 4000 years from 3113 BC. In this same toponym the "source" of the flowing Feathers is defined as a five-fold jade-like object, symbol of precious water: that the jade could in fact be worth a fifth of 400, i.e. 80 years, is made abundantly clear from independent sources in the C11 tradition. A "Jade" of 80 years is unmistakably marked out in the Cuauhtinchan History between the years 1176, 1256 and 1336 AD, 9 Flint, 11 Flint and 13 Flint: these two 80-year periods are designated by a Jade emblem and are glossed with the phrase "the Jade (chalcatl) was completed". A good iconographic example occurs

in Boturini (p. 13) where doubling as the place-name Chalco "the shrine of jade" it marks the period between the Aztec's arrival in the first local town of their migration, the place of rushes Tula-Xicocotitlan in 3 Flint 1144 AD, and their arrival in Chalco with its maguey leaves in 5 Flint 1224 AD (cf. Sigüenza Map 1167 to 1247 AD, and Fig. 6a, 7).

Once recognised for what it is, the Jade can be detected in a variety of further sources. In the Zacatlan History collected by Torquemada, the opening span of 720 years (which separates Xihuitlapopoca of the late 14th century from the C11 Round 72 base) consists of nine "model" reigns each one Jade or 80 years in length. Then in the C10 tradition, in the Bachelorhood of Eight Deer, it functions more complexly, in combination with the Round (equal to the 52 divisions on the Jade's rim), at the highly resonant moment in the Era chosen by that hero for his one fire-kindling, 1047 AD, exactly 80 Rounds or 52 Jades (4160 years) from 3113 BC (3113+1047 = 4160; Fig. 6b). The probability of this reading is much strengthened by the otherwise meaningless alphabetic gloss on the "Jade-Round" emblem itself, which points to the Era base by citing the Nahua name of the Era as such in the cosmogonical sequence of five Suns, i.e. "nauhollin", "4 Movement" (Sign XVII: cf. Plates 1, 2); the aptness of this gloss further increases when it is considered that Eight Deer's kindling divides this 5200-year Era in exactly the ratio, 4:1 (80+20=100 Rounds), which it itself is defined by in the 26000-year cycle of five Suns (400+100=500 Rounds). The Jade appears again in the Borgia, on the Tecuililhuitl page of the Fasts chapter (p. 30), which is dedicated to Series I year bearers: there in its dominant central position the Jade has its rim inset, analogously to the Eight Deer example, with the tooth-total of 32 double bars. In sheer arithmetic this again yields the five-Sun cycle of 26000 years, less one Head: 80x32x2x5 = 25600 years.

As the material jade, the 80-year period may readily be seen as one set of a repertoire of tribute year-multiples mineral in nature, extrapolated from the year itself in its homonym "turquoise" (xiuitl). For in certain Era datings the Head seems to occur as a large rock while the four-year Series Sign or leap-day span may be identified with a stone or flint (Flint years appear to be leap years in Series III). Reading the stone as 4 years makes detailed sense of the difference between the two Nepopualco Maps, 4 stones or 16 years, which the second of them glosses in Nahua as "iqhuac centlalicue", the "extra bit"; for this is exactly the difference between 1 Flint of Round 72 in C1 (632 AD) and in C11 (648 AD), Round 72 being the Chichimec base used by both Maps to establish the date 1466 AD (written in arabic numbers in the text; Plate 5).[13] Then in the Ihuitlan Map (Fig. 6c), the year given above the toponym, 1 Reed, may be similarly pinponted if 8 years or two stones are seen to be subtracted, literally, by the snake that lies among the 400-year Feathers: for the overall distance from 3113 BC to 1 Reed of Round 76, 879 AD, is 3992 years or ten Feathers less two stones. It should however be emphasized that these deductions are of a different order from those made concerning the 80-year Jade, since this last is so unambiguously confirmed as such in the Cuauhtinchan History.

As for year multiples stemming from the ritual tonalamatl rather than tribute arithmetic, the scholarly outlook is bleaker, there being no generally agreed identification of markers for the 52-year Round or comparable periods. This must in part be attributed to negligence. For example, little notice has been taken of the 7-year sequence of year guardians, derivative from the Nine Figures, which is so clearly spelt out and identified with the Sign Deer (VII) in the Borbonicus screenfold (pp. 21-2; Fig. 5c).[14] Again, the same narrative that so cleanly defines the Jade, the Cuauhtinchan History, likewise exposes a remarkable and no less neglected 40-year period known as the Cuauh- or Eagle-Quecholli, here rendered as "Cross Eagle" since this is how it is depicted iconographically. Moreover, this period is just as cleanly defined in other Chichimec sources. Attached always to Reed years in Series III, the Cross Eagle is distinguished by the fact that the Numbers qualifying this Reed Sign follow each other in ascending order, to the limit of 13, which is 520 years or a decimal Round; and that the Numbers-plus-Signs which spell out these lots of 40 <u>years</u> in the Round of years also spell out 40 <u>days</u> in the tonalamatl, so that the distance from 1 Reed to 2 Reed is both 40 years and 40 days. As the two highest fliers among the 13 Quecholli (Fig. 5e), the Eagle (5) and his bald companion (8) mark out this 40-year period in the annals of the "eagle" towns Cuauhtinchan and Cuauhtitlan, while the toponym Cuauhquechollan in the Mendoza (p. 42) consists of the bald Eagle (8) together with five dots (for Eagle). In the Cuauhtinchan History the two Eagles cross their necks diagonally in a literal multiplication sign, i.e. 5 x 8 = 40 (Fig. 6d): placed with the years 1 Reed (1259) and 2 Reed (1299), this refers to the 40-year periods 1219 to 1259 and 1259 to 1299 which both in this text and in the Cuauhtitlan Annals are glossed with the phrase "the Cuauhquechollan element was completed". Beyond this, when qualified by each of the thirteen Numbers in turn, these 40-year units build up into the full Cross-Eagle Count of 520 years (= 13 x 40 = 52 x 10), the decimal Round otherwise associated with the Quecholli (cf. note 9) and examplified with the same 1 Reed date in the Tepexic Annals (Fig. 3c) and possibly in the Borgia (p. 71, Plate 2).

Regarding markers for the 52-year Round (Fig. 5b), the situation has been bedevilled mainly by the fact that there has been little effort to concert such explanations and decodings as have been offered, those of Caso being a notable example (1967: 16). For his part Walter Lehmann drew attention long ago to the iconography of the Round as a "year-binding", xiuhmolpilli in Nahua; totals of five Rounds (260 years) are for example confirmed by ties in narratives like the Mexican Annals (1247 to 1507 AD) and the Tepechpan Annals (1299 to 1559 AD). And he went on to make the quite reasonable suggestion that the knots and ties attached to year names at one Round intervals in such cases could <u>of themselves</u> denote a Round. He then applied this idea to such texts as the Aztec Sunstone (Plate 1), where four such ties or molpilli are bracketed on the outer band of fire snakes (Lehmann 1974: 322-23); cf. Ibarra Grasso 1978). Permutated with the 18 dots which accompany these four molpilli, Lehmann's reading can in fact be satisfactorily related to the Chichimec Round 72 base, since 4 x 18

= 72 Rounds; and it can be applied also to the four lots of four molpilli shown with the Aztec fire-kindling year 2 Reed in the Borbonicus (p. 34; Plate 6), so as to identify it as the Huizachetepec kindling of 1507 AD, 4 x 4 or 16 Rounds from the 72 Round base (the toponym Huizachetepec appears in the text).

Moreover, the all-important principle established by Lehmann may be extended to other xiuhmolpilli iconography, notably the fire-kindling scrolls of flame and breath (ayauitl) to which the ties are related in these two sources and yet more systematically so in Féjérvary pp. 5-14. In both the Huitzilopochtli histories, Ríos and Telleriano Remensis, three double breath-scrolls of this type confirm the six Rounds or 312 years that have elapsed between 1196 and 1508 AD, at the latter date (Fig. 6e). In the Boturini screenfold nine such breath-scrolls or 468 years, uttered by Huitzilopochtli from his cave in Colhuacan (p. 1), carry us tidily from 1 Flint 648 AD (the Chichimec base) to 1116 AD, the start of the continuous year count in that text (Plate 7). Then, from the same base, the 14 flame-scrolls in the Azcatitlan Annals confirm emperor Acamapichtli's inaugural year 1 Flint 1376, 14 Rounds or 728 years later (p. 22). Counting from the earlier base in Round 60, appropriate to its C10 convetion, the Acatlan Genealogy (Egerton; Plate 9) shows 16 such scrolls as breath and 10 as flame to place the 16th generation at 12 Flint 1388 AD (pp. 4, 20), the date independently estimated by Burland (1965). In all these cases the Round markers are so positioned in relation to the year dates they locate as to leave little doubt about their relevance to them or that they indeed have numerical value.

The consistency of these examples (which could be multiplied) with the chronological framework established earlier encourages us to turn to what appears in context and function to be an iconography equivalent to that of the tie and the scroll, in other C11 texts and in most major C1 and C10 texts (Fig. 5b). Conceptually the key to this other iconography lies in the notion of the body's nine orifices, "rounds" literally as that, presided over by the Rain-god in his role as as the ninth of the the Nine Figures and hence, with his full waterbag, of the nine moons of pregnancy and gestation, during which these orifices form. It is notable that the molpilli tie actually substitutes for the Rain-god as the ninth of the Nine Figures in Cospi pp. 1-8, while in the Azcactitlan Annals (pp. 28-42) the three fire-kindlings of Tenochtitlan's hegemony in 1403, 1455 and 1507 AD, between Huitzhuitl and Moctezuma II, are also marked by the Rain-god and the cradle of his new-born. Similarly, the Rain-god faces the tangle of 19-20 scrolls below the 8 Rabbit date in the Teozacoalco Map, confirming it as 1046 AD, almost 20 Rounds from the C10 base; and he appears to qualify as Rounds the 13 units on the opening emblem of the Vindobonensis reverse, confirming the accompanying 7 Flint date as 720 AD, independently established by Caso, as 13 Rounds from the C10 base.

In addition to this, as properties of the Rain-god particular orifices of the body can be seen to assert themselves as markers, notably the lips or mouth, terrestrial as a cave, and the eye, celestial as a star. For example, the toponym Chicomoztoc or

Seven Caves may be rendered specifically as the seven orifices of the head when embodying the span of 7 Rounds or 364 years (Fig. 6g; cf. Cuauhtitlan Annals f.1). As the commonest orifice markers, the cave-mouth and star-eye are amply confirmed by their appearance and use in the continuous year-narratives, where they ratify significant totals of Rounds.

Sums of mouth-Rounds appear in the Tepexic and the Tilantongo Annals alike, where on each occasion they pick out in the continuous year narrative, a given period of calendrical or historical significance. Hence the ten mouths which attach to the second of two 1 Reed 1 Alligator dates at Rounds 14 and 24, 2345 to 1825 BC in the Tepexic Annals (pp. 8-9) ratify the distance between them as a decimal Round or Cross-Eagles Count of 520 years; again the ending date in the same narrative 2 House Round 86, 1361 AD (p. 50), is surrounded by 14 mouths which place it symmetrically both 14 Rounds <u>after</u> the restoration of Round 72 and 14 Rounds <u>before</u> the Era's full complement of 100 Rounds (cf. Fig. 3a). At the start of the Classic and of chapter 2 in the Tilantongo Annals (p. 14), the year 7 Reed 343 AD is framed by 6 cave-mouths: these correspond to the 6-Round distance from the tree-birth of Round 60, the C10 base (Plate 8).

In these examples the mouth markers simply reaffirm dates already established in a continuous year count: in the complex and problematic Cuauhtinchan History, however, they make it possible for the first time to calculate the proper time-depth of the narrative, which begins in the great Tula on the Gulf Coast. For prior to the continuous year count which begins only in 9 Flint 1176 AD (p. 51), time is measured by "years" and "days" which are qualified by this same mouth marker, called "precious lips" or quetzal-teueyac in the text (Fig. 6f). The 59 "years" and 13+10 "days" in question are said to "walk the road of Toltec Rounds" (p. 13: yn otli y xiuitl ynic ualneneque yn tolteca yn Icxicouatl yn Quetzalteueyac), which suggests that they should be in fact counted as Rounds. So that at the start, in the year-set, to move from 1 Flint to 2 House involves a span not of 1 but of 53 years, 3112 to 3059 BC, a 53-year kindling span having actually been observed around Cholula (cf. Caso and Smith 1966: 30; also Molina on the xiuhmolpilli of 53 years). Similarly, in the day-set 8 Eagle to 7 Deer, and 8 Rabbit to 4 Movement, the periods involved are not days but Rounds-plus-days: even on historical grounds they cannot be interpreted literally as days on account of all that happens in them.

Read thus, the sequence of these mouth Rounds in the Cuauhtinchan History makes perfect sense in the framework of the Era. For the 59-year-Rounds and the 13 day-Rounds combine to produce the Chichimec Round-72 base while the further ten-Round distance to the start of the continuous year-count in 1176 AD is provided by the second run of day-Rounds, ten in all. Once accorded this order of time-depth the narrative, with its repeated migrations and settlements, acquires a clarity it is otherwise bound to lack; and as its subtitle suggests it should it can then serve as an excellent guide to "Toltec-Chichimec history". For after the initial diaspora it reports in detail such events as the

Toltec struggles against the Xicalanca Olmec at Cholula around Round 50 or 500 BC, a date corroborated by Sahagún, Ixtlilxochitl, and the Tepexic Annals; the famous Chichimec emergence from Chicomoztoc or Seven Caves in Round 65 (late 3rd century AD), exactly the date given in the Tilantongo Annals (p. 10) and in the Cuauhtitlan Annals, as 7 Rounds or 364 years before Round 72 (f. 1); and then the great circle of their clockwise progress down the Gulf Coast, through Anahuac, Tepanec lands in the west, the highland valley and finally the portals of Popocatepetl and Iztaccihuatl, eastwards back to Cholula, at dates between Rounds 72 and 82 (mid 7th and late 12th centuries AD) reciprocally confirmed at every stage by documents from the towns involved. Along with the Cuauhtinchan Map and the closely allied Borgia screenfold (cf. Nowotny 1961: 34 and Brotherston 1982: 54) this text, with the aid of these Round markers, becomes a major guide to the whole Chichimec historical tradition.

More frequent and freer-standing than the mouth, the star-eye readily identifies itself as a Round-marker in Tilantongo texts like "Eight Deer in Tututepec" (Becker screenfold) and the Tilantongo Annals. In both these cases the star-eyes reaffirm, from the Round 60 base, dates that are already well established, like the dynastic shift around 800 AD, Round 75 or (60+) 15 star-eyes (Tilantongo Annals, pp. 4, 14 and 22; Plate 8) and Eight Deer's kindling in 1047 AD, Round 80 or (60+) 20 star-eyes (Becker). In the Vindobonensis reverse (pp. 9-11; Fig. 6h) three Rounds of life at Tilantongo after Eight Deer's death in 1063 and until the early 1220s are celestially noted as three star-eyes. A star-eye also appears among the 14 flame- or Round-scrolls in the Azcatitlan Annals and may be identified with the "ixtetlil comoloua" star-eye marker inset into Itzpapalotl at Round 72 in the Cuauhtitlan Annals, in the C11 tradition. Whole bands of star-eyes introduce texts from the Anahuac and the Tilantongo domains (Gómez de Orozco, Selden Roll; Selden p. 1, Bodley p. 2). And on each occasion the dates they establish in Rounds fit perfectly into the Era scheme as a whole. The 60 star-eyes in Gómez de Orozco lead straight from the Era base to the time of the tree-birth; for their part the 65 star-eyes in the Selden Roll lead to the Chicomoztoc or Seven Caves event which indeed appears in the text immediately afterwards, Round 65 or the mid 3rd century AD being the date independently recorded for this event in the Annals of Tilantongo and of Cuauhtitlan and in the Cuauhtinchan History (Plate 11).

In the Selden Roll, the narrative continues after Chicomoztoc/Seven Caves along a sky road to a barrier of rocks at Ihuitlan, where a fire-kindling is orchestrated by Two Dog in the year 10 House; and then it returns along the same road to Chicomoztoc and the date 8 Flint. As before, the position of these events in the Era is given in Rounds by star-eyes, 17 on the way to Ihuitlan and 10 on the way back. Added to the initial 65 star-eyes, the 17 place Two Dog's kindling year in Round 82, i.e. 1161 AD, which is just ten years prior to the kindling by Two Dog recorded in the Tepexic Annals (7 Reed Round 82, 1171 AD, p. 43). Moreover, Two Dog's kindling occurs three star-eye Rounds after the appearance of Four Alligator which is exactly the interval given by the Tepexic Annals, where Four Alligator presides over the seventh

kindling in 1015 AD (p. 41), and by other Anahuac texts (Maps of Ihuitlan, Tlalpitepec and Coixtlahuaca ii).[15] Returning from Ihuitlan the final ten star-eyes take us on to Round 92, so that the year 8 Flint should be read as 1692 AD: this is identical with the final projected date in the Tepexic Annals (8 Flint Round 92, 1692 AD, p. 52), the "12-Head" total at 12/13 of the Era which can be shown to have marked a historical turning point for the surviving priests and scribes of the Anahuac and Toltec traditions to which all these texts belong (Brotherston 1982: 27). In any case, the repeated coincidences between the Tepexic Annals and the Selden Roll tend reciprocally to confirm the time-depth of the former and the 52-year value of the star-eye in the latter.

In the Tilantongo texts, the opening star-eye totals of 6 and 15 mentioned above coincide with the start and end of the "Classic" chapter common to the Tepexic and Tilantongo Annals, at 6 and 15 Rounds from the tree-birth of Round 60, Rounds 66 and 75 of the Era. In this the Selden is especially gratifying since, like the dual wheels in Mexicanus p. 9 and like the "nauhollin" gloss on Eignt Deer's Jade-Round kindling, it provides its own small key to Mesoamerican chronology (Fig. 6i). For the six star-eyes which establish the Classic start date 4(?) Reed 327 AD, 6 Rounds from the Round 60 Base, carry below them an unobtrusive but most pertinent statement of their Round position in the Era. It consists of the number 66 spelt out in bars and dots and subdivided right to left as 21+45: the logic of this stems from the fact that 66 is one of the rare sigma numbers to have as possible components two smaller sigma numbers (i.e. $\Sigma 6 + \Sigma 9 = \Sigma 11$, or $21+45 = 66$). Hence we may be confident in seeing here a reminder that Round 6 of the Tilantongo convention equals Round 66 of the Era.

More and more examples of these orifice Rounds, mouth and eye, could be winckled out of Mesoamerica's iconographic texts and every time could be shown to yield apt and significant datings. And the discussion of Round markers as a whole could be extended to the more esoteric varieties: the 20-Round or millennial tree five of which, in the centre and the four tribute fields, complete the Era (cf. A. Castellanos's detection of the four "1040-year" markers at the start of the Tlalpitepec Map; Corona Núnez 1964-67: iii: 114); the 13 Quecholli who according to their inherent values may individually embody decimal Round totals (cf. Itz-papalotl and Round 72 above, and the Eagle 50 plus 5 star-eyes placed at 5 Flint Round 55, 248 BC, Tepexic Annals p. 14; Plate 10); and the 13 Heroes who according to their inherent values may individually embody ordinary Round totals (cf. Sun 4 plus Quetzal-snake 9 as 13 Rounds or "676 years" in Historia de los mexicanos). Each carrying 100 flame scrolls or snakes (mixcoa), two of these last on the Sunstone, Hero Sun (4) and the Hero Fire-lord (1), supply in Rounds (i.e. 400 + 100) the same 26000-year cycle noted above as 65 Heads: and as in the Cuauhtitlan Annals, where "CCCC mixcoa" likewise establish the same ratio and total of Rounds (400 + 100), the sheer arrangement of the Hero Rounds, 400 pre and 100 post, pinpoints 13 Reed as this Era's inaugural Series III year (Plate 1).

But such further exploration belongs elsewhere, along with the fact that in the International Day Count of Mesoamerica this Era's

name as a Sun, 4 Movement, corresponds to the spring equinox of 3113 BC; and that the widely-reported 26000-year cycle, five times this fifth Era's 5200 years, equals the full precession of the equinoxes. The detail given already is more than enough to reveal the use of year-multiples in the year calendar, within the previously established scheme of the Era and its secondary bases. As is shown in Fig. 7, year multiples persistently corroborate dates independently established in continuous year counts; and taken together they leave no doubt, in particular, about the true formal length of the year span in the Tepexic Annals.

Conclusion

Over the four sections of this paper, the attempt has been made to establish Anahuac as the home of the only remaining major group of uncorrelated Series III texts; to ascribe to that group a year correlation whereby 1516 AD = 1 Flint ("Cl"); to show that the time depth in the chief text of the group, Vindobonensis obverse or the Tepexic Annals, far from being illusory is commensurate with the Era span of the tun calendar and extends to 13 Reed (Cl) 3113 BC; and finally to explore the use of year-multiples like the Head and the Round, within the Era framework. In this last, certain of the year multiples, like the 80-year Jade and the 40-year Cross Eagle, though neglected are quite unambiguously defined in native sources; others, however, like the "mouth" and "eye" Round have had to be deduced by less direct means, which could of itself prompt debate. For that reason it should be emphasised again that the main argument of the paper is not in any way obliged to invoke these multiples: it is merely supported by them, including the firmest of them, like the Jade. As for the correlating of 3113 BC with the year 13 Reed, through Cl, this is achieved according to norms generally respected in Mesoamerican calendrics, while the time-depth from this inaugural year established for the Anahuac texts results from a wholly orthodox and conservative reading of the year dates in the Tepexic Annals, and from their incessant parallels with those in tun and and other calendar year texts, even a few of which would be enough to make the case in principle. And nowhere is the notion of "scribal error" appealed to, to explain away awkward discrepancies; rather anomalies previously deemed mistakes are shown to be deliberate and meaningful.

Though in turn the source of further valuable confirmation, certain aspects of the Anahuac tradition have been left unexplored, for lack of space: their documentation of the lowland Tula on the Gulf Coast, the first city named as such in east and west Mesoamerica; their clues to the native distinction between the International Day Count of Mesoamerica (tonalpoualli) and the day-in-the-year count of the year calendar (cemilhuitlapoualli); their astronomical data, like the sidereal year cycle of the Tepexic Annals (Fig. 3c) which impinges on the whole concept of the 26000-year precessional cycle; and the degree to which texts like the Anahuac Map, with its hidden year-dates, render invalid the customary division made between ritual (synchronic) and historical (diachronic) texts, the former being more like condensed hence poetic syntheses of both cosmic and political time. Other essential

Fig. 7 Compendium of Series III dates with year multiples
(A= Annals; M = Map)

Correlation 1: year 0 Round 0 = 3113 BC 13 Reed

Era	BC	
2865	248	5 Flint, Eagle+5 eyes+5 years (5, 55x52); Tepexic A p.14 (Pl.10)
	AD	
3160	47	1 Reed, 60 eyes (40, 60x52); Gómez de Orozco p.1
3420	307	1 Reed, 65 eyes (40, 65x52); Selden Roll (Pl.11)
3918	805	5 House, (60+) 8+7 eyes (18, 75x52); Aubin ms 20 (Fig.1c)
3992	879	1 Reed, 10 Heads less 2 Stones (4000-8); Ihuitlan M (Fig.6c)
4160	1047	(13 Reed), Jade-Round (80x52); Zouche reverse p.35 (Fig.6b)
4274	1161	10 House, 65+17 eyes (10, 82x52); Selden Roll
4474	1361	2 House, (72+) 14 mouths (2, 86x52); Tepexic A p.50
4525	1412	(1 Flint), (1+) 3x29x52 years; Mexicanus p.9 (Pl.4)
4529	1416	5 Flint, (805 AD +) 12 eyes less 2 heptad leaves (12x52 less 14 inclusive); Aubin ms 20 (Fig.1c)
4805	1692	8 Flint, 82+10 eyes (21, 92x52); Selden Roll

Correlation 10: year 0 Round 0 = 11 AD 13 Reed

sum	AD	
228	239	7 Reed, 4 eyes (20,4x52); Yolotepec M
273	284	13 Flint, 5 scrolls (13, 5x52); Acatlan Genealogy p.1
316	327	4 Reed, 6 eyes (4, 6x52); Selden p.1 (Fig.6i)
332	343	7 Reed, 6 mouths (20, 6x52); Tilantongo A p.14 (Pl.8)
681	692	5 Flint, 13 eyes (5, 13x52); Bodley p.2
709	820	7 Flint, 13 units with Rain-god (33, 13x52); Vienna reverse p.1
768	779	1 Reed, 14 scrolls (40, 14x52); Nativitas M
816	827	10 Reed, 15 eyes (36, 15x52); Selden p.2
820	831	1 Reed, 15 eyes (40, 15x52); Tilantongo A pp.4-14-22 (Pl.8)
1035	1046	8 Rabbit, 19 scrolls with Rain-god (47, 19x52); Teozacoalco M
1036	1047	9 Reed, 19 eyes (48, 19x52); Eight Deer in Tututepec
1214	1225	5 House, (20+) 3 eyes (18, 23x52); Vienna reverse pp.9-11 (Fig.6h)
1377	1388	12 Flint, 26 units with Rain-god (25, 26x52) Acatlan Genealogy pp.4-20 (Pl.9)

Correlation 11: year 0 Round 0 = 647 AD 13 Reed

sum	AD	
469	1116	1 Flint, 9 scrolls (1, 9x52); Boturini p.1 (Pl.7)
496	1143	2 Reed, 9 scrolls (28, 9x52); Xochicalco New Fire Stone
529	1176	9 Flint, 10 mouths and days (9, 10x52); Cuauhtinchan H p.51 (cf.Fig.6f)
548	1195	2 Reed, Hero 5 twice (28, 10x52); Rios p.87
577	1224	5 Flint, (1144 AD +) 1 jade (80); Boturini p.13 (Fig.6a)
600	1247	(2 Reed), 1 jade and Hero 5 twice (80, 10x52); Sigüenza M 'Chalco' (jade is chalchiuitl)
612	1259	1 Reed, hinge of Cross Eagle Count 1219-1259-1299-1339 etc: Cuauhtinchan H, Cuauhtitlan A, Borgia p.71 (Fig.6d; Pl.2)
689	1336	13 Flint, (1176 AD +) 2 jades (80x2) Cuauhtinchan H
708	1355	6 Reed, 13 eyes with 9 (32, 13x52); Santa Cecilia Tlaloc
728	1375	13 Reed, 7x2 eyes (14x52); Sunstone (Pl.1; cf. Mendoza Pl.3)
729	1376	1 Flint, 14 flames with eye (1, 14x52); Azcatitlan A pp.22-3
784	1431	4 Reed, 2 Heads (800) from 13 Reed C1 631 AD; Quinatzin M 2
811	1458	(5 Rabbit), 2 Heads (800) plus 10 years; Tlatelolco A*
816	1463	10 Reed, (1363 AD +) 5 Flags (100); Aubin
819	1466	(13 Rabbit), 2 Heads 3 Stones 6 years (818); Nepopualco Mii*(Pl.5)
825	1472	6 Flint, 15 ties (46, 15x52); Tula Caryatid
833	1480	(1 Flint), 16 eyes (1, 16x52); Tizoc Stone, top (88 in the Era)
860	1507	2 Reed, (1247 AD +) 5 ties (5x52); Mexican A
		2 Reed, (1195 AD +) 6 scrolls (6x52); Rios (Fig.6e)
		2 Reed, 4x4 ties (28, 16x52); Borbonicus p.34 (Pl.6)
874	1521	(3 House), (1458 AD +) 3 Flags (60) 3 years; Tlatelolco A
912	1559	2 Reed, (1299 AD +) 5 ties (5x52); Tepechpan A

*From 1 Flint 648 AD

factors that have had to be left on one side include the whole question of the historical progress through the year Series (I, II, III, IV; Fig. 2b) and the huge importance of the archaeological Monte Albán sequence from at least 500 BC; the ritual patterning of year multiples and their association with particular moments in the Era (e.g. Seven Caves as the Rounds 65 to 72); and the principle of shifting between number bases (e.g. the 5-year bar and the 50-year stick in Laud, p. 44) and between dimensions in time, as via the great year of 26000 years to the evolutionary scheme of five Suns, for which 100s of millions of years are recorded hieroglyphically.

In sum, this is very much a first step, a new orientation which if at all correct offers to reveal coherence in the year calendar hitherto denied or not seen. Above all, read as they demand to be, the Anahuac texts, like the tun texts of the Maya lowlands, provide the "missing link" in Mesoamerican chronology, a time-depth that conjoins the political history of such centres as Tenochtitlan, Tilantongo and Tepexic with the awesome scheme of Suns spelt out in the Cuauhtitlan Annals and the Popol vuh.

Notes

1 For a summary of the various correlations proposed for the tun calendar, see Kelley 1976: 30-33. Added proof for the Goodman-Martínez-Thompson correlation appears in Lounsbury's study of the Dresden Venus tables, published in this volume, and in Edmonson's translation of the Chilam Balam Book of Tizimin (1982; cf. note 5); also the succession of katun dates in the first chapter of the Chilam Balam Book of Chumayel (pp. 2-15) can be shown to support Thompson's "11.16" katun formula (cf. Brotherston 1982: 31).

2 The main reasons for believing the year of the year calendar to be tropical-seasonal rather than metric are as follows:

a) as a set of four, the year-bearer days (e.g. 13 Reed) are distinguished from other days by just the markers otherwise used to identify the tropical year of agricultural tribute, while at Monte Albán the set existed in its own right and was identified by the seasonal Rain-god (cocijo);

b) particular year Series Signs are identified with good or bad rains and harvests, which of course depend on the tropical rather than the metric year, so that in Series III for instance Rabbit (Sign VIII) meant drought; also the 20-day divisions of the agricultural (i.e. tropical) year are regularly intercalated with the Series Signs (e.g. in the Series II annals of Tlapa or Azoyu, and in the Ríos from Quecholli 1 Reed to greater Tecuililhuitl 2 Flint, November 1519 to July 1520);

c) native chronographers like Chimalpahin correlate native with Christian (i.e. tropical) years over spans in which more than a year's difference accrues between the tropical and the metric year, without regard for that difference;

d) in native correlations, year names are made exactly equivalent, for example as lungs breathing in time (see below), which they could not be as tonalpoualli days of the metric year (on the progression through the year-bearer Series cf. Fig. 2b and Edmonson 1982: 195); also the tonalpoualli day given for Cortés's arrival (8 Wind) is quite distinct from the cemilhuitlapoualli day in the seasonal "month" Quecholli (1 Wind).

3 Over the vast span of the Tepexic Annals no less than ten characters named Two Dog (Sign X) are featured in the narrative, one of them twice, each being distinguished by a unique combination of headdress, ear-plug and emblem-load. Five of them are designated as principals by an emphatic eye-marking and by having (with one exception) a contemporary and surrogate of the same name (p. 23, 354-63 AD, start of chapter 2; p. 28, 510 AD, pulque ritual; pp. 30-31, 722-24 AD; p. 32, 805 AD, Jaguar Claw president of the second kindling, without partner; p. 43, 1171 AD, president of the ninth kindling); the first of them appears alone near the end of chapter 1 (p. 20, 173 AD). When not otherwise stated, the Two Dog referred to in this paper is the one who lived in the latter half of the 12th century AD and who presided over the ninth kindling in the Tepexic Annals, where he is shown with a feather headdress, oblong ear-plug and a tobacco gourd (yetecomatl).

4 The east-west-north-south sequence of the Quecholli (cf. Fig. 5e) is 12-1-3-13 in Féjérváry (a tribute map consonant with the one in Mendoza, Plate 3) and 12-5-8-4 in Borgia; in Dresden (pp. 25-28) the four quarters give the bar-and-dot total of 59, twice the lunar 29.5 days, and bear the moon glyph. For the Tepexic, Tilantongo and Tenochtitlan totals see Fig. 1d; in each case east is the source of cacao. The elaborate tribute symbolism of four fields, trees and feeding birds is explained to some extent in the last chapter of the Museo de América Codex; on the lunar-solar significance of the tribute ciphers 29, 246 and 365, see Brotherston 1982a. The Tepexic toponym has been previously identified by Jansen (1982), though with scant regard for the actual positions of it and other Anahuac towns or their general separateness from the southern Mixtec-Tilantongo tradition, and by Chadwick (1971: 477) who, following Caso (1960: 58), points to its dynastic importance for and rivalry with Tilantongo as part of an Anahuac federation that included Xicotlan northeast of Coixtlahuaca (Caso 1961: 242), Cholula, and the "Sun" town Tehuacan.

5 Edmonson discusses in detail the reasons behind the Vallodolid Reform of 1752 which extended the tun Era to 2088 (1982: 172, 194, 197). However, while pointing out the lowland Maya's interest in reconciling their 360-day tun with Christian and Mexican tropical years, he does not specifically note that 2088, 4 Ahau in the tun calendar, marks the completion of 100 Rounds or 5200 such years.

6 Besides Nowotny, both Caso and Melgarejo considered that to read the Tepexic Annals normally would yield an "impossible" time-depth (cf. Davies 1977: 68). It is noteworthy that precisely when denying this time-depth Nowotny chooses to derogate the capacity of Mesoamerican script, reducing it to the merely mnemonic: "Diese

Schrift ist, wie wahrscheinlich auch die der Maya, trotz ihrer vielen phonetischen Elemente und trotz der exacten chronologischen Angaben eine durchaus piktographische, d.h. sie erfordert einen mündlichen Kommentar" (1961: 48).

7 On the Euripos or Navel of the Sea mentioned in Plato's *Phaedo*, cf.: "We meet the name again at a rather unexpected place, in the roman circus or hippodrome, as we know from J. Laurentius Lydus (*De Mensibus*, I, 12), who states that the centre of the circus was called Euripos; that in the middle of the stadium was a pyramid, belonging to the Sun; that by the Sun's pyramid were three altars, of Saturn, Jupiter, Mars, and below the pyramid, altars of Venus, Mercury and the Moon, and that there were not more than seven circuits (*kykloi*) around the pyramid, because the planets were only seven" (Santillana and Dechend 1970: 206-7). On the apparently identical arrangement of sun plus planets, 3 superior and 3 inferior, at Palenque, cf. Brotherston 1982a: 110.

8 At these dates in the Palenque panels the emblem used involves either the sun glyph (kin) or Ahau (Sign XX) as in Fig. 4b; on this cf. Kelley 1976: 278. On the Hiatus, see Willey 1974.

9 For the Quecholli, see Fig. 5e; and for other examples of this convention, see Plate 2 (Quail, 4, as 40 Rounds), Plate 10 (Eagle, 5, as 50 Rounds), and Brotherston 1982: 56 (Owl, 6, as 60 Rounds). For more details of the Cll texts involved, see Nicholson 1978.

10 Widely commemorated in the Aztec tradition, this year appears to be established on this same page of the Mexicanus in the Christian Era, by data to the left of the two wheels, viz. 4 Feathers (1600 years) less 3 Flags (60 years, cancelled by shading) plus 18 dots, i.e. 1600-1540-1558 AD; this is followed by year 2 Reed (1559) and a further 12 dots (Plate 3). The present reading of Mexicanus p. 9 revises certain details of my previous attempt (1982: 87), of which Hanns Prem has kindly offered well-justified criticism.

11 Important early notes on the use of the Head and the Round in the year calendar include Gemelli 1700: 38 (*re* Hero Rounds in the Sigüenza Map), Borunda 1898 (1794-95), and Fábrega 1899 (1792-97, drawn on by Humboldt 1810 and more recently by Broda 1969); see also Chavero 1892, vol. 2, A. Castellanos 1912 (*re* Fábrega's 20-Round or 1040-year period in the Anahuac texts, *cf.* Corona Núnez 1964-67, iii: 114), and the works by Lehmann and Caso quoted below. A vocabulary of Mixtec terms for such periods has been generously reported to me by M. Dürr.

12 Good examples of these techniques appear in the pages of bar-and-dot numbers in the Féjérváry (pp. 5-22) and the Cospi (reverse pp. 1-11). Decimal value is well expressed in the angled-bars of the former (e.g. pp. 14-15), in the 2460 sidereal moon total of the latter (i.e. 10 x 246 or nine sidereal moons: cf. Fig. 1d and note 4), in the Quecholli decimal Round convention and many other aspects of the Mesoamerican ritual; sigma value is inherent in the very position of Eagle in the Quecholli (5) and the Twenty Signs

(XV) respectively (cf. Brotherston 1982a). Modern survivals of these techniques are reported though little commented upon by van der Loo (1982), e.g. the squaring of 13 (p. 235) and the equation of four moons with a Mercury year (4 x 29 = 116, p. 234).

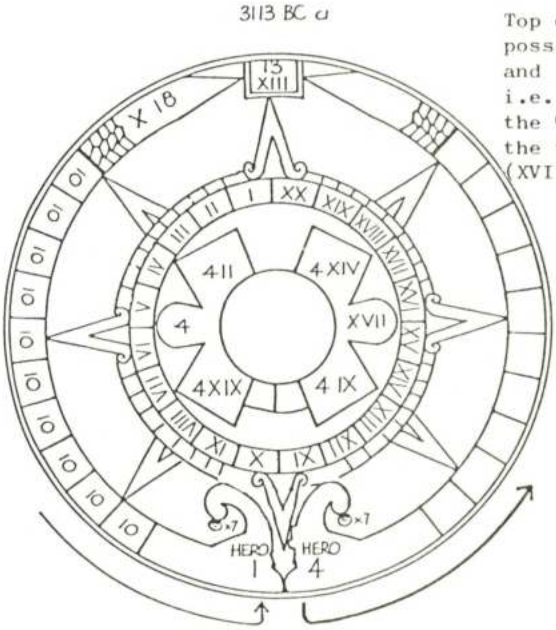
13 A third copy of this Map, not mentioned in the Handbook of Middle American Indians Census and equivalent to the 632 AD Map, has been reported and described by Prem (1972), who, however, in identifying all three Maps with Santa María Nepopualco, Puebla, interprets the stones as boundary markers and the two 400-year Feathers as ravines (he does not comment on the six xihuitl ends of the boundary cord). In native terms both readings may of course be possible, especially since the element -poal- in the toponym is known to refer to counting in general and to counting by 400s in particular (cf. the Christian Era count in Mexicanus, Pl. 4 and note 10). This same multiple reading of native iconography is after all clear enough in star-eye Round markers which actually shine from the sky, and in cases like the Selden Roll where the rocks as Ihuitlan ($10^3/4$) and Chicomoztoc (12) prove to confirm in Heads the date established for these places in Rounds (1171 and 1692 AD). On stone and Flint imagery attaching to "dropped leap-day" formulae in Aubin ms 20, the Tepexic Annals (pp. 31-41) and the Tilantongo Annals (p. 3), see Brotherston 1982a: 123.

14 Ritually a penance period (as for Tula's One Reed, Chadwick 1971: 477), seven years is a prime factor in such larger multiples as Seven Caves (364 years) and the ideal lifetime of 70 years recorded in the Mendoza and found throughout North American chronology (Brotherston 1982: 39; 1982b; 1983a); in Boturini p. 1 (Plate 7) it appears with decimal angle-value to give three such lifetimes or 210 years, the distance to the end of the text (p. 21).

15 The great calendrical importance of Four Alligator can be judged by the fact that his kindling both completes the 5-Round leap-day sequence (see note 13) and is the first to be measured as an exact Round 963-1015 AD. He is exactly contemporaneous if not identical with the founder of the second Tilantongo dynasty and father of Eight Deer, Five Alligator, also a calendrical reformer. (Shifts of one number in names are common in the Mixtec and Anahuac traditions).

Plate 1 Sunstone

3113 BC a



Top centre: inaugural year of the Era 13 Reed (C1), 3113 BC; possibly also 13 Reed (C11), 1375 AD (cf. Plate 3). Right and left rim: 10 x 10 Round-flames in the Hero ratio 4:1, i.e. 20800 pre-Era years right, and 5200 Era years left; here the Chichimec Round-72 base appears as 4 x 18 ties. Centre: the tonalamatl name of the Era or Sun 4 Movement or Quake (XVII), incorporating the names of the four previous Suns.

BC	3113	13 Reed (C1)
	3744	4 x 18 x 52
AD	631	13 Reed

	647	13 Reed (C11)
	728	2 x 7 x 52
	1375	13 Reed

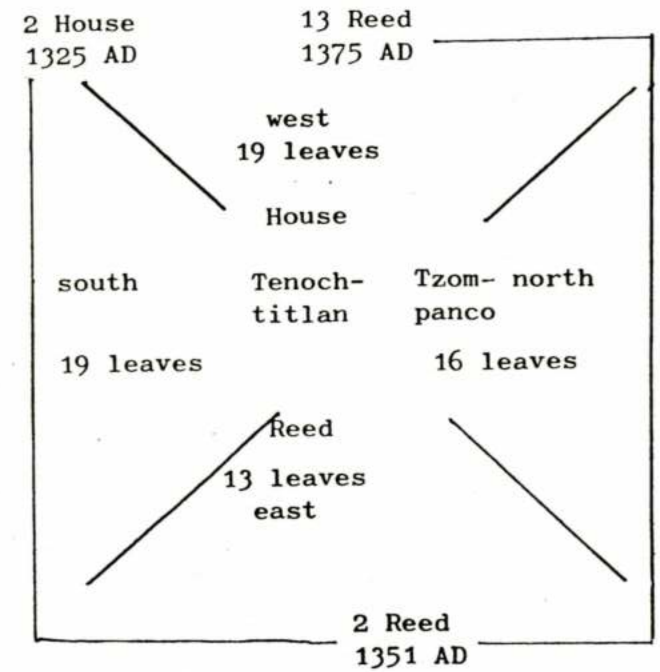
Plate 2 Borgia p. 71

13	12	11	10	9
	1 Reed 1259			8
5x20R			4R	7
Hero 4			40R	
			40R	6
4 Movement				
1	2	3	4	5

On his throne, Hero 4 (Sun) drinks the blood of a decapitated Quail (flier 4) while the head of another lies below; the Quecholli frame indicates a Cross Eagle Count to 1 Reed 1259 AD, in line with that in the Cuauhtinchan History and Cuauhtitlan Annals: the position in the Era is given by the two Quails (2 x 40 Rounds) plus the blood spurts from the neck of the upper Quail (4). The blood flow then baptises as Rounds the five Flags held by the Sun to give the span of the Era (5 x 20 Rounds), the name of which appears below his throne (4 Movement). As on the Sunstone (Plate 1) this distance is then multiplied by his Hero number to give the pre-Era span of 400 Rounds.

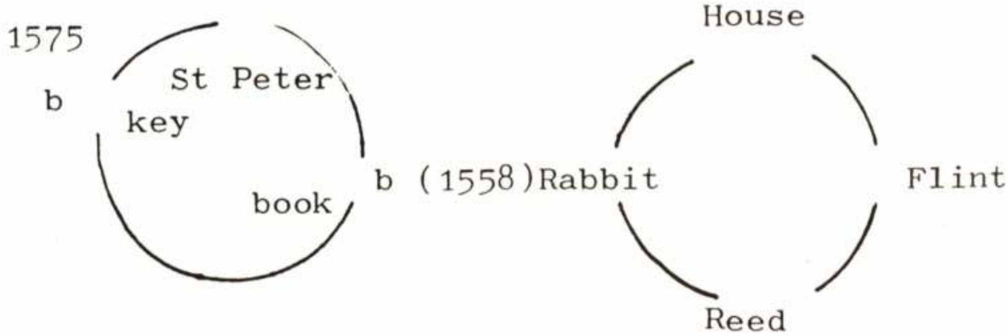
BC	3113	13 Reed (C1)
	4368	2x40x52 4x52
AD	1255	13 Reed (C1)
	1259	1 Reed (C11)

Plate 3 Mendoza p. 1



Around the central toponym of Tenochtitlan, the relative positions of its four tribute fields are given by Tzompanco (skull-rack), due north and to the right. Around the rim run the years from 2 House 1325 to 13 Reed 1375, 2 Reed 1351 being picked out as a kindling year. Totalling 51, these years are matched in the map area by the 51+16 years shown as leaves in the four quarters, the extra 16 reflecting the gap between C1 and C11 year names; also the totals to west and south amount to Metonic cycles. The 14-Round distance from the Chichimec base is recorded in the 7 cactus spikes pronounced to be Rounds by Tenoch's scroll, these being multiplied by the 2 of the 4 years of the stone beneath that are actually named on the map, House (west) and Reed (east).

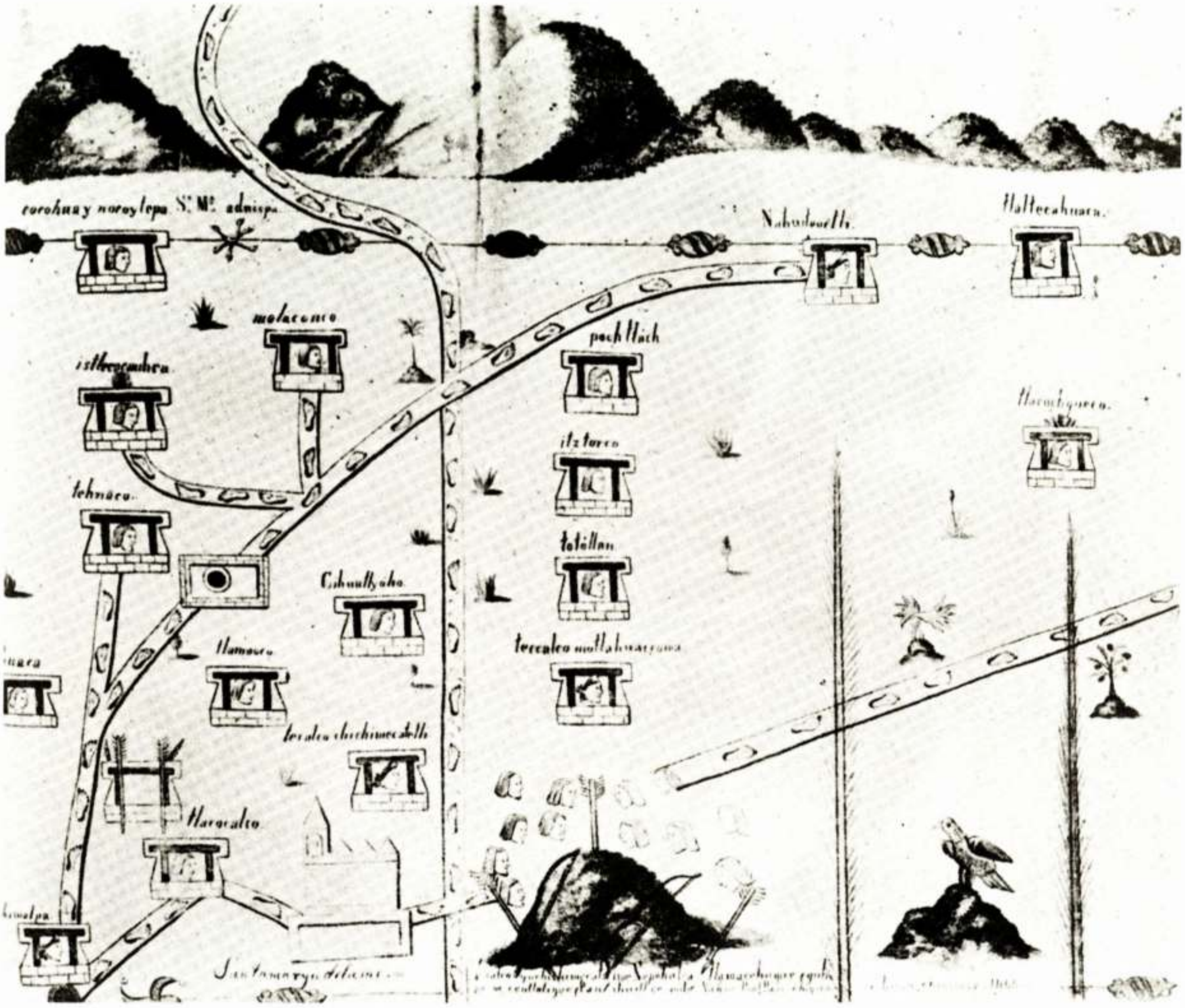
Plate 4 Mexicanus p. 9

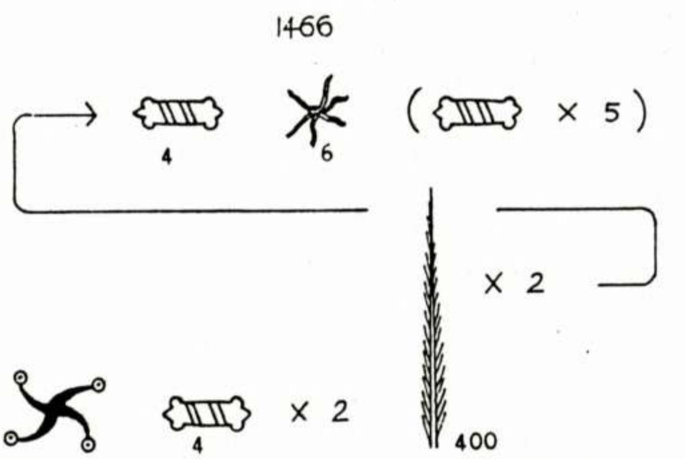


Of the two wheels, the Mesoamerican one (right) shows a Series III Round while the Christian one (left) shows a solar cycle; they mesh at 1 Rabbit (C11) 1558 AD. In the Era this date is reached through three full turns of the two wheels (St Peter's key, 3x29x52 years) plus five turns of the Christian wheel (St Peter's book, 5x29 years); the 400-year feathers, 20-year flags and dots to the left, at right angles, appear to confirm the same date in the Christian Era, immediately prior to the 2 Reed kindling year lower left (cf. note 10).

BC	3112	1 Flint (C1)
	4524	3 x 29 x 52
AD	1412	1 Flint
	146	5 x 29 excl.
	1558	1 Rabbit (C11)

Plate 5 Nepopualco Map ii





AD 648 1 Flint (C11)

818 { 2 x 400, 3 x 4, 6 }

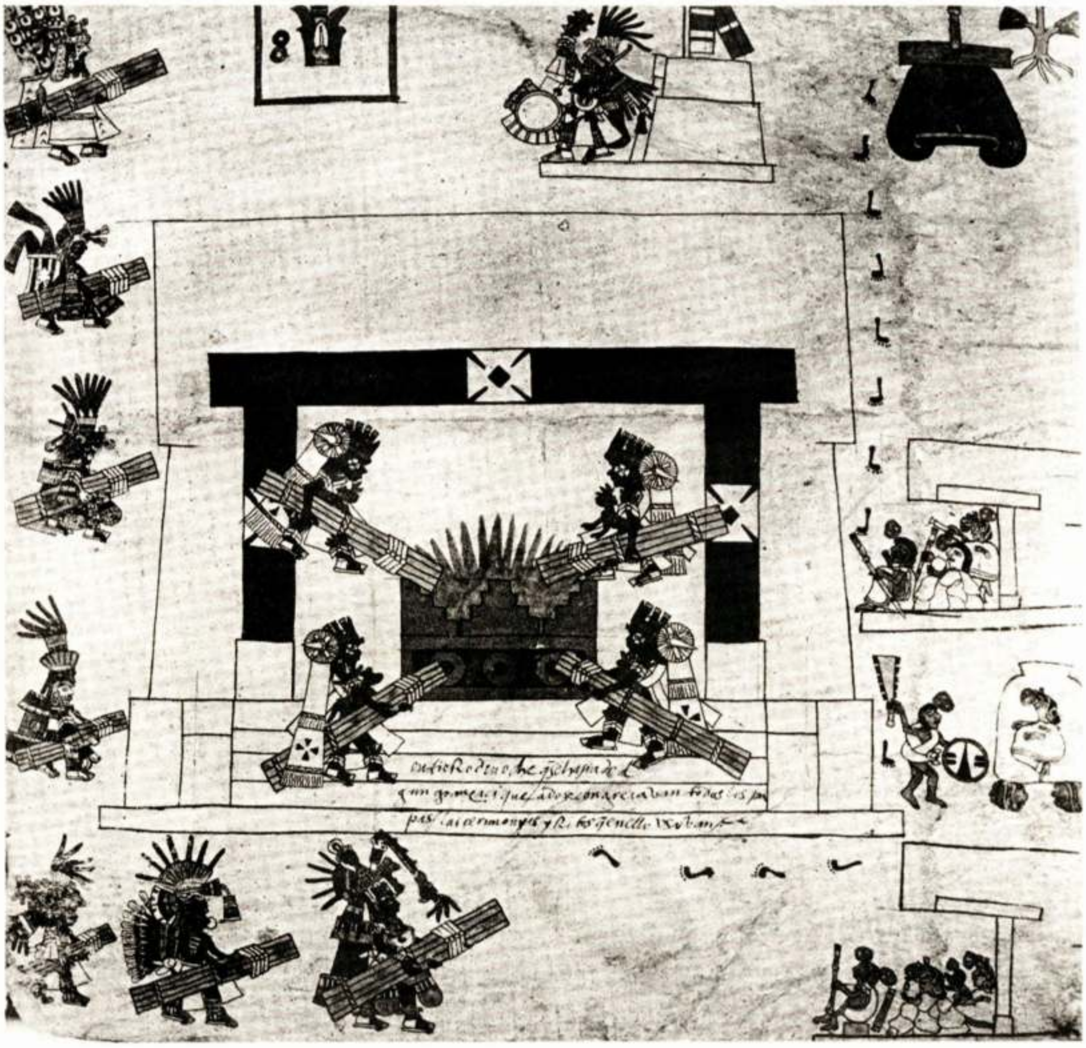
1466

yncalco
ynchichimeca

400

The Christian date '1466' is counted out by feathers, stones and grass cords from the Chichimec base (yncalco yn chichimeca), Round 72. In the complementary Nepopualco Map i, the count is from 632 AD, also Round 72 but 1 Flint in C1 rather than C11; the 16-year gap is shown as four stones, here glossed as 'Yquhac oc centlalicue', 'with the extra bit'.

Plate 6 Borbonicus p. 34

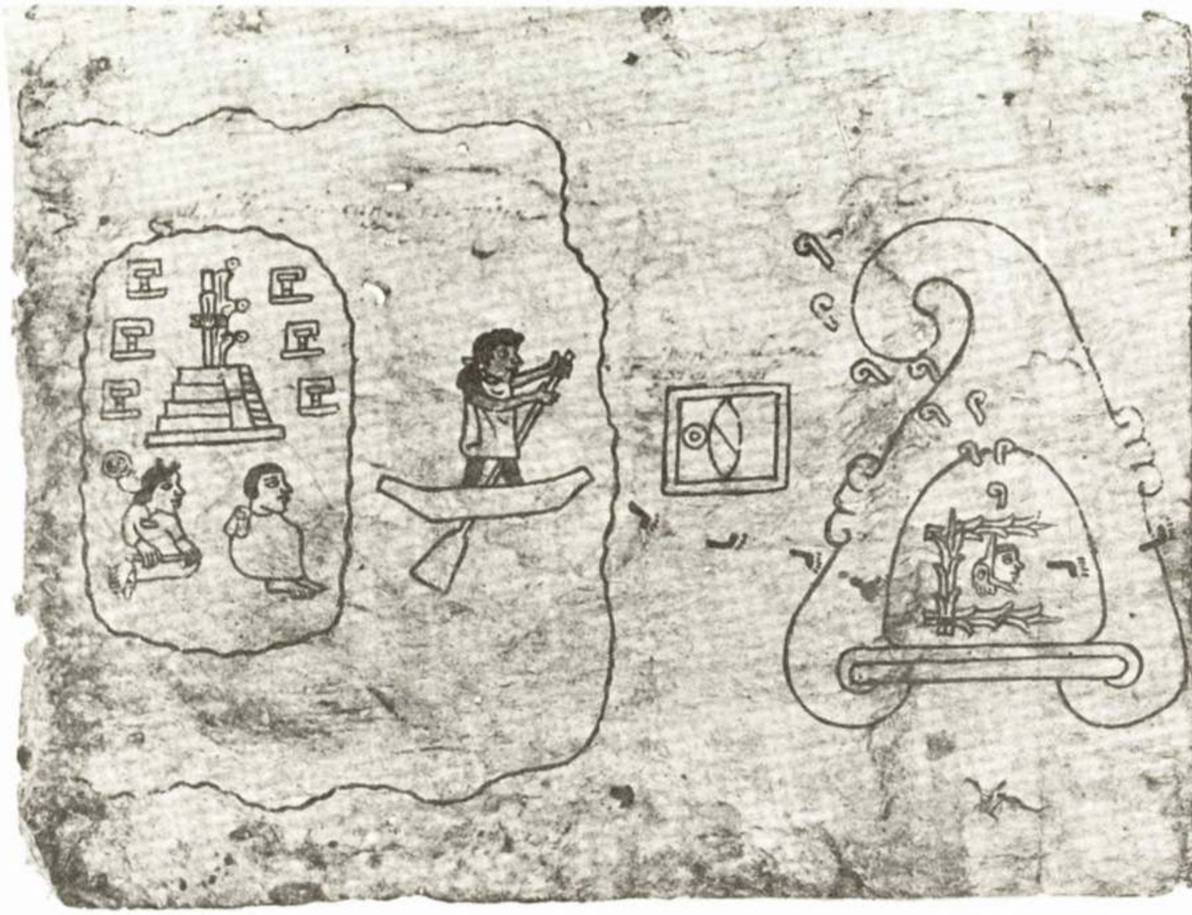


4 2 Reed Huizache
| 1507 AD -tepetl
4
|
4 4 4
|
4 4 4 = 16R
|
4— 4— 4 = 28R (+72 = 100R)

In the year 2 Reed 1507 AD, New Fire is brought from Huizachetepetl to Tenochtitlan. The ties on the firewood around the furnace give the distance in Rounds from the Round-72 base while the distance to the full 100 Rounds of the Era appears in the supplementary firewood.

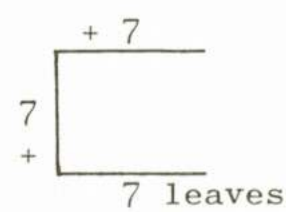
AD	648	1 Flint (C11)
	832	16 x 52
	1480	1 Flint
	1507	2 Reed

Plate 7 Boturini p. 1



9 scroll
Rounds

1 Flint
1116 AD



The distance to the year-date 1 Flint 1116 AD from the Chichimec or C11 base (Round 72) amounts to nine Rounds: these are shown as breath scrolls uttered by Huitzilopochtli from within the cave at Colhuacan. From there the frame of three heptad leaves, with its 90° angles, projects to the end of the Aztec migration in 1325 AD (cf Plate 3 and note 14).

AD	648	1 Flint (C11)
	468	9 x 52
	1116	1 Flint
	209	3x7x10 incl.
	1325	2 House

Plate 8 Tilantongo Annals p.14

cave-mouth Rounds 3+

star-eye Rounds 8+

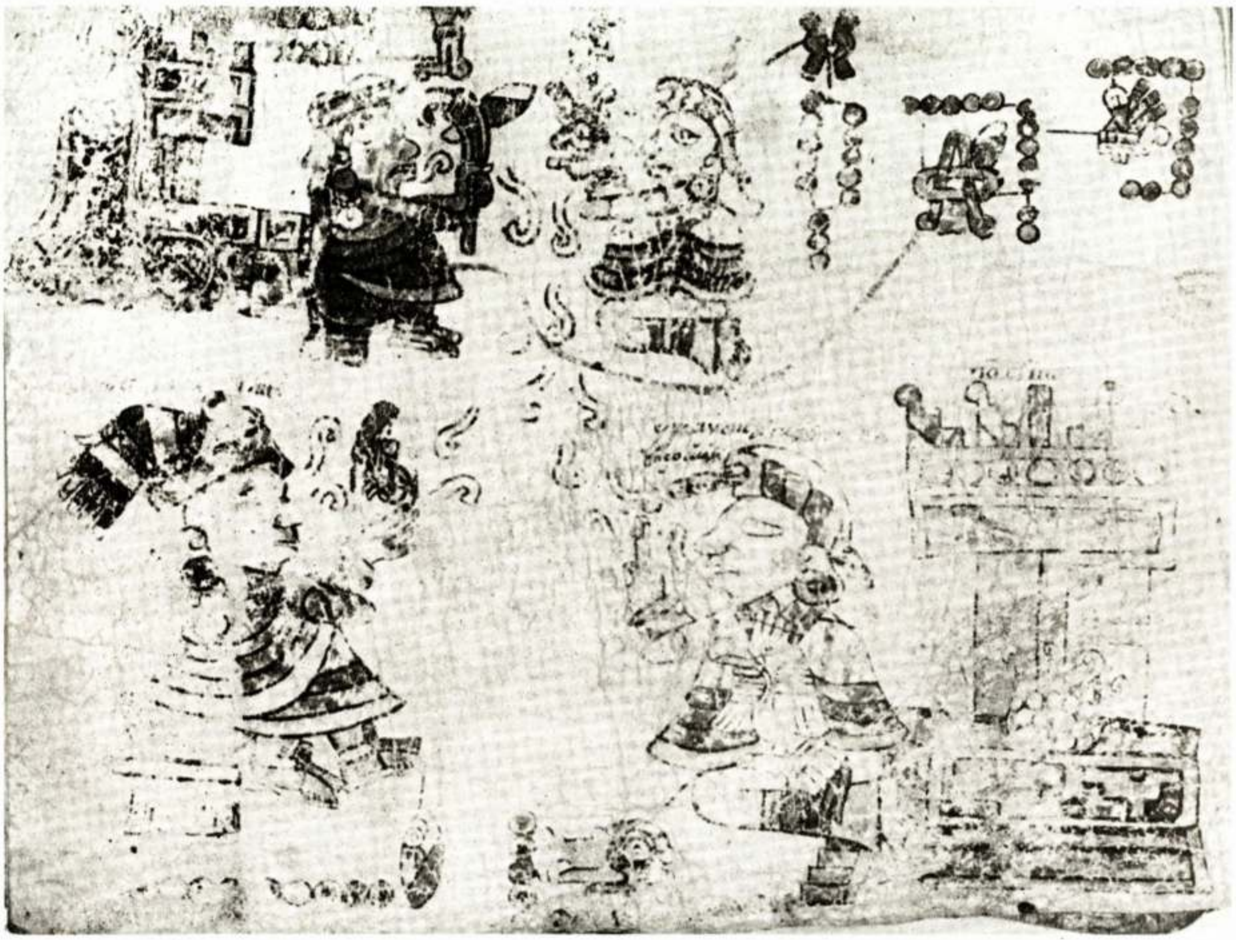
7 | 3

lady
Three
Flint 7 Reed
343 AD

The year-date before lady Three Flint is 7 Reed (C10) 343, which is measured from the Round 60 base by the surrounding six cave-mouths; this marks the start of the Classic. The distance to the end of that period is given in the band of 15 star-eyes (Round 75).

AD	12	1 Flint (C10)
	312	6 x 52
	324	1 Flint
	343	7 Reed

Plate 9 Acatlan Genealogy p. 20



5

4 7 12 Flint

3 2 1388 AD

?5

5 + 16 + 5 = 26 Rounds

The key and final date in the text, 12 Flint (C10) 1388 AD. ritually attaches to the 16th generation, 16 pages and 16 Rounds from the introductory time-marker which records 5 + 5 Rounds from the Round 60 base and anticipates the 16 Rounds to come (p.4). Here, these Rounds appear as breath scrolls uttered by the two couples, while the flames issuing from the temples behind them make up the overall 26-Round distance from base.

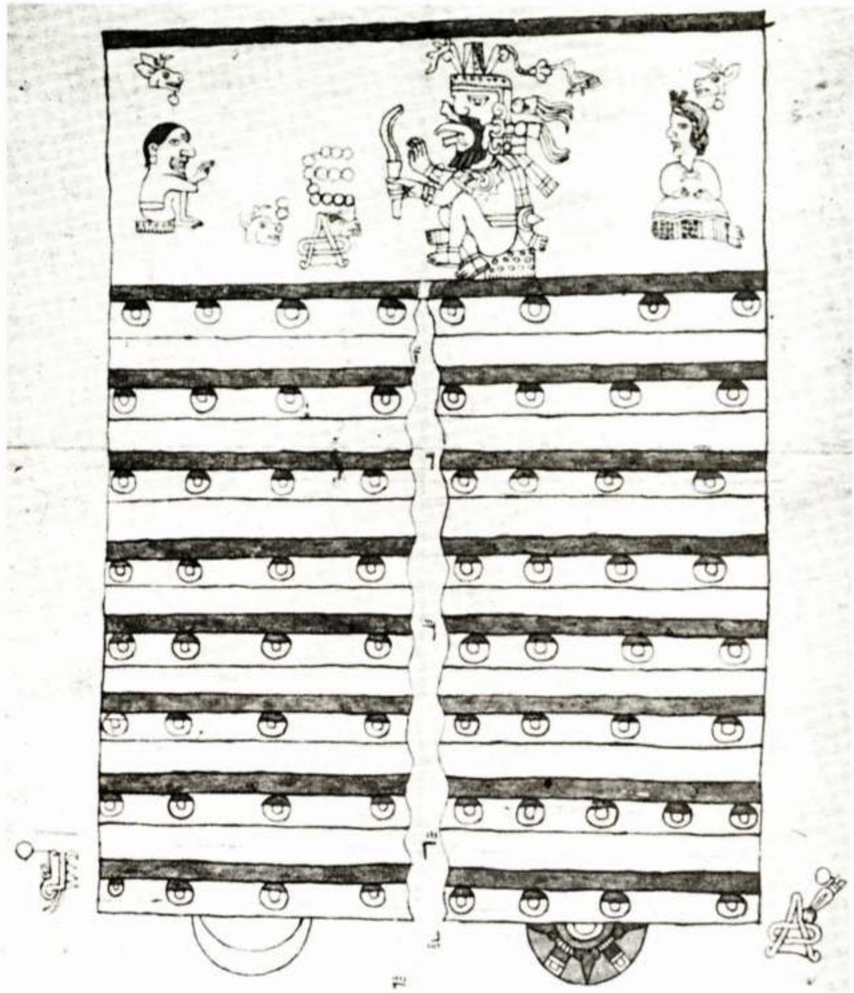
AD	12	1 Flint (C10)
	520	10 x 52
	532	
	832	16 x 52
	1364	1 Flint
	1388	12 Flint

Plate 10 Tepexic Annals p. 14

5 XVIII		5 XVIII		8 XVIII		7 III	
55.5	248	54.5	300	50.21	492	49.46	519
1 XIII		7 XIII		8 XIII		6 XVIII	
55.40	213	53.20	337	51.8	453	49.45	520
7 XIII		1 XIII		7 XIII		7 XIII	
56.20	181	52.40	369	51.20	441	49.20	545
						(Round.year)	(BC)
		1 XIII					
		51.40	421				

Following a boustrophedon line from 545 BC bottom right to 181 BC bottom left (13 dates and 7 Rounds in all), events in the Era are attached to years and to toponym symbols; note the four snow mountains 520 BC which in fact are uniquely visible from Cholula (cf. Fig.1a). Top left the date 5 Flint 5 Flint 248 BC stands exactly 55 Rounds from the first year named in the text (5 Flint 5 Flint 3108 BC p.3); this distance is confirmed by the temples of the Eagle (i.e. 50) and the stars (5) to either side of the '7 Flower' tribute house, which confirms the year 5 Flint as the fifth of the Round.

Plate 11 Selden Roll opening



One Deer One Deer

13 Rabbit 2974 BC

8
8
8
8
8
8
9
8

= 65 Rounds

1 Reed 307 AD

Between sun (left) and moon (right) the descent from **the sky-womb passes** via 65 star-eye Rounds, from 13 **Rabbit 2974 BC** to 1 Reed 307 AD. To either side of **the Wind-masked figure** in the sky (named Nine Wind **in the Tepexic Annals**) sits the ancestral pair of **the Anahuac tradition**, female and male One Deer, **the first pair named** in the Tepexic Annals (cf. Fig. 3a).

BC	3113	13 Reed (C1)
	(2974	13 Rabbit)
	3380	65 x 52
AD	267	13 Reed
	307	1 Reed

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Numbers in parentheses refer to the Census of Native Middle American Manuscripts (1975) by John B. Glass (native script, 1-699), Donald Robertson (Techialoyan, 700-999) and Charles Gibson and John B. Glass (alphabetic, 1000-), which gives full bibliographical details. In all cases the revised paginations follow Corona Núnez (1964-67), Laud being the only exception. Bibliographical references supplement those in the Census. MNA = Museo Nacional de Antropología, Mexico.

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Selden (283)

Selden Roll (284)

Sigüenza Map (290)

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Telleriano Remensis (308)

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GARY URTON and ANTHONY F. AVENI

Archaeoastronomical fieldwork on the coast of Peru

The archaeological record of monumental architecture in Pre-Columbian Peru testifies to a remarkably high level of activity within the numerous river valleys which cut from the east to the west across the dry strip of coastal desert. This activity dates from several millenia B.C. until just before the time of the Spanish conquest. The exposed ruins are now in varying states of decay, and any information which can still be gleaned from the record is of utmost importance in providing relatively accurate data for present and future studies. In that light, the purpose of this report is two-fold: first, to present an account of a series of precise alignment readings, made with a surveyor's transit, of orientations at 14 archaeological sites from the Lambayeque valley in the north to the Rio Grande de Nazca in the south; secondly, to present these data in the context of an argument, built on ethnoastronomical and archaeoastronomical observations derived from the Peruvian coast and highlands, for what appears to be a consistent interest in aligning structures to the rise or set of a few specific celestial phenomena.

Table 1 gives a descriptive analysis of each alignment taken by the authors. Descriptions of the specific features measured and any additional explanatory comments are provided in the Appendix. Due to the effects of precession of the equinoxes, the azimuths of orientation to the rise or set of stars will change through time (the effect is negligible for the sun and moon). Therefore, we have provided approximate dates for the sites as determined from a review of the archaeological literature. The table also includes the azimuths of rise or set of the astronomical phenomena which, we will suggest, may have been important in the orientation of these structures.

At the beginning of our interpretation of the data collected in the field, we were aware that it would be possible to attempt to match site orientations with the rise or set of celestial bodies by simply scanning computer charts containing the appropriate latitude, time period and horizon elevation for each site. Given the number of possibilities, however, one could be relatively certain of finding an astronomical match for each orientation, given a standard allowance of 1°-2°. Therefore, we were primarily interested in the degree to which the site orientations would, or would not, confirm a hypothesis for those alignments which should exist. After a statement of our hypothesis, we will conclude with a discussion of how well it is supported by the evidence.

The Hypothesis

The study of archaeoastronomy and ethnoastronomy in Peru has advanced most rapidly in the southern highlands, in the Dept. of Cuzco. These studies, dealing with the astronomy of Inca, Colonial

and contemporary populations, have made it clear that a relatively small number of celestial phenomena were central to the astronomical and calendrical systems which were, and still are, adapted to this region. As space does not allow a detailed account of how and why each of the phenomena discussed below are important, we will refer the reader to a number of references (Aveni 1981; Urton 1981; and Zuidema 1977 & 1981) and only mention the principal phenomena here. They are:-

a) The rise and set of the Pleiades;
b) The sunrise and sunset on the day of passage of sun through zenith;
c) The sunrise and sunset on the day of passage of sun through anti-zenith[1].

These phenomena, important primarily because they relate to critical periods in the agricultural and ritual cycles, were of utmost importance in Incaic astronomy and calendrics, and they are still employed usefully for precise astronomical observation among contemporary Quechua-speaking populations in the Dept. of Cuzco.

The majority of alignment readings in Table 1 pertain to coastal rather than highland sites; the one exception is the central highland site of Chavin de Huantar. Therefore, it is significant to find that, in addition to data supporting the central role of the Pleiades and the zenith and anti-zenith sun from the highlands, the ethnographic and ethnohistoric documents from the coast also attest to the importance of these same phenomena. There are several accounts referring to the role of the Pleiades in the astronomy and calendars of the coast, beginning with the 17th century account of Antonio de la Calancha:

> They (the Chimu) do not count the year by Moons or by the course of the Sun, but rather from the rise of the stars which we call the Cabrillas (the Pleiades) and which they call Fur. The reason for this is found in a long fable, which is none of my concern. It was a law that they counted the year thusly, because these stars gave them food and nurtured their crops, for their livelihood, therefore, they had to begin the year from the time they saw it appear and it gave them sustenance. (Calancha, 1638:554).

Calancha's account relates to the Pacasmayo valley, on the north coast, where the Indians were Yunga-speakers and descendants of the Pre-Columbian Chimu culture. The term given by Calancha for the Pleiades, Fur, is also recorded in the 17th century Yunga dictionary of Carrera ((1644)1880). In a discussion of the astronomical phenomena observed in the community of Huarochiri, Avila (1966, Ch.29) also mentions the cabrillas (Pleiades) and describes how they were observed in agricultural prognostications. From the same period (1656), we have a document on "idolatries" from San Pedro de Acas giving the testimony of one Hernando Hacas Poma in which the Pleiades are referred to by the Quechua term oncoicoillor ("sickness star"). San Pedro de Acas is located near Cajatambo, some 80 km inland on the central coast; the Pleiades were observed here in the 17th century to time two annual festivals which were

attended by people from several coastal valleys; one festival in November, Pocoimita, could have been timed by the heliacal set of the Pleiades on November 18 while the other festival, Caruamita, was held on Corpus and San Juan when, as the document says, the Pleiades appeared and the frosts began (Huertas Vallejos, 1981: 50-53, 71, 105,106 and 115). In addition to these ethnohistoric references, Gillin's ethnography of the communities of Moche and Huanchaco on the north coast refers to the role of the Pleiades (las cabrillas) in coastal navigation and time-keeping (Gillin, 1947:34). Zuidema (nd.) gives additional early references to the Pleiades.

Documentation from the coast concerning the importance of the zenith and anti-zenith passages of the sun is not as direct as that for the Pleiades. It is possible that the zenith sun of Feb. 23 was used to time the festival of Yuc Yuc in San Pedro de Acas; this festival was related to the end of the rainy season and the plowing (barbecho) of the potato fields. The other zenith passage on Oct. 23 could have been used to time one of four "solar" festivals held in October in the nearby community of San Juan de Tulpay (Huertas Vallejos, 1981: 52 and 71). October was also the month of celebration of the one annual lunar festival in San Juan de Tulpay; this month may therefore have been the time for correlating the solar and lunar calendars. Similarly, the festival of oncoyllocsiti, held in August in San Pedro de Acas, may have been timed by the August 27 anti-zenith passage of the sun; the same anti-zenith passage may have been used to time another of the four "solar" festivals in San Juan de Tulpay, a solar festival said to have been celebrated in August (Huertas Vallejos, 1981: 53 and 71).

It has also been argued, on the basis of the ethnographic record, that the zenith and anti-zenith passages of the sun have been important for some time in the agricultural and fishing calendars of three north coastal communities, Santiago de Cao in the Chicama valley and Moche and Huanchaco in the Moche valley (see Sabogal Wiesse, 1975; Gillin, 1947 and the analysis of these data in Urton, 1982).

On the basis of these data from the coast, as well as the comparative material from the highlands, the hypothesis which we wished to test with our field data was as follows: if astronomical phenomena played any sort of role in the orientation of coastal sites, then those events we should expect to find represented in the alignments would be the rise or set points of the Pleiades and the zenith and anti-zenith passages of the sun. It should be emphasised that we do not necessarily assume that the sites were, in fact, astronomically aligned; the supposition which qualifies our hypotheses allows for the possibility that sites may have been oriented in a particular direction for any number of reasons (e.g. topography, the desire to take advantage of cool ocean breezes, respect for sacred mountains, etc.). To re-emphasise a point made earlier, the primary function of our report is to make the data in Table 1 available, while a secondary purpose is to test one particular hypothesis, out of several potential hypotheses, for explaining why the particular orientations might have been chosen.

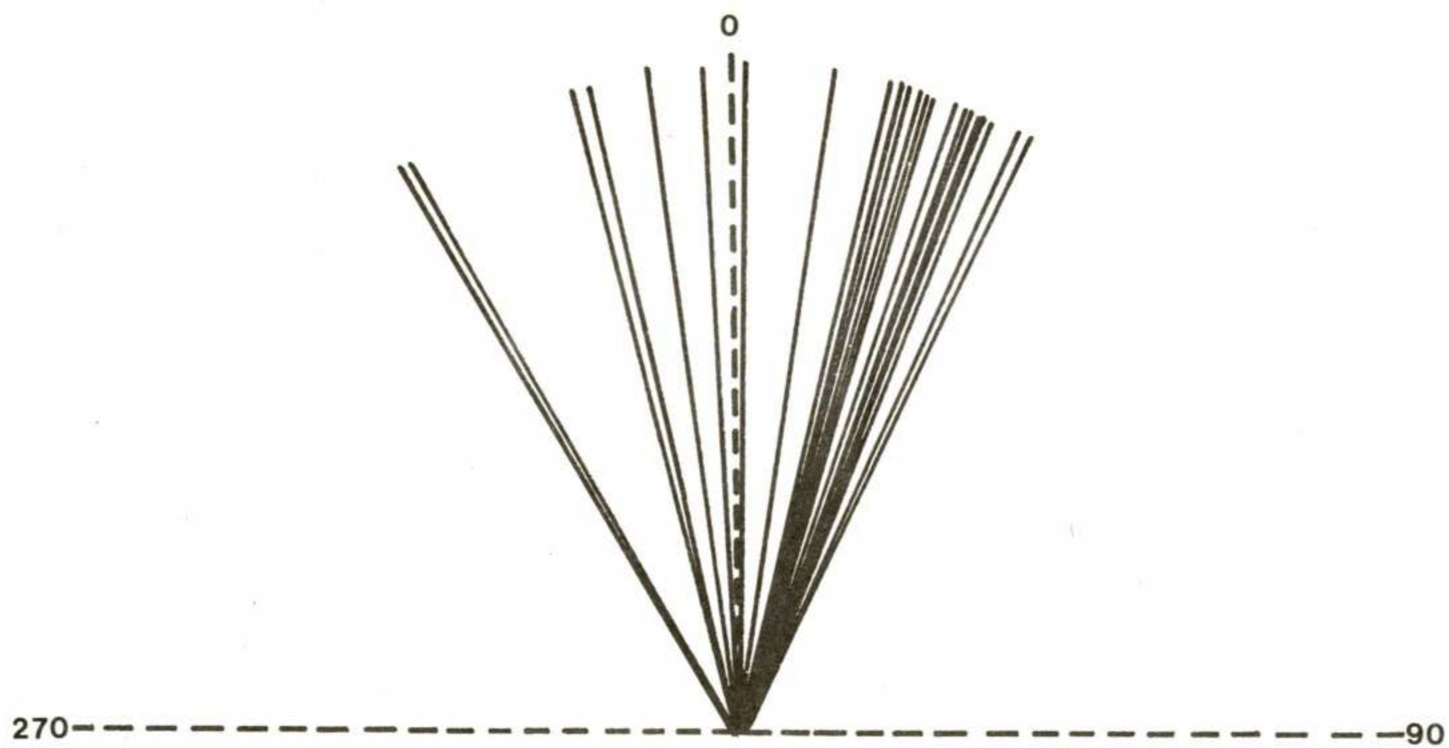

Fig. 1 Distribution in azimuth of alignments of structures at sites surveyed along the coast of Peru

Conclusions

That the documentation for the astronomical and calendrical importance of the Pleiades is greater than that for either the zenith or the anti-zenith solar passages is also reflected in the alignment readings. This is especially true on the north coast, the territory of the Chimu, who, according to Calancha, counted their year by the Pleiades. The correlations between site orientations and the azimuths of rise and/or set of the Pleiades, and the amount of deviation between the two, can be summarised as follows: Batan Grande (about 1° in 500 A.D.); Pacatnamu (about 2° in 1000A.D.); Huaca de la Luna (less than 1° in 200 A.D.); Ciudadela Tschudi (less than 2° in 1400 A.D.); Ciudadela Bandelier (less than 1° in 1350 A.D.); and possibly Chavin (here the errors are somewhat larger owing to a high, variable horizon.). The correlations, given the particular dates, are quite close.

There are fewer correlations between site orientations and either the zenith or anti-zenith passages of the sun, but the existing correlations have a very small deviation. For either the zenith or the anti-zenith, the correlations are: C. Sechin ($\frac{1}{2}^{\circ}$), Paramonga (less than 3°), Tambo Colorado (less than $\frac{1}{2}^{\circ}$), and Cahuachi (about 1°). The orientation out the doorway of the Huaca de Loro includes a range of azimuths from 58° - $79^{\circ}03'$ which would have allowed a view of the rising of both the Pleiades and the anti-zenith sun.

Figure 1 displays the general distribution of alignments with respect to the clockwise or counter-clockwise skewing from the cardinal directions for all sites reported in Table 1. Though we can provide no causal argument at this point in our studies, it should be noted that in most cases the orientations are skewed clockwise from the cardinal directions, the same pattern which has been found in similar site orientation surveys in Mesoamerica (see Aveni, 1980, Ch.5 for details). This result is in general agreement with the results given in the only other coastal alignment survey, that of Williams (1978) on U-shaped structures. It is perhaps of some significance for the Peruvian case that many of the clockwise skewed orientations in Mesoamerica can be accounted for by employing astronomical hypotheses.

We conclude from previous observations that the data tend to support the part of our hypothesis concerning alignments to the Pleiades, especially for sites on the north coast. While the number of sites having zenith/anti-zenith alignments is not large, it is interesting to note that most sites which exhibit these orientations are located either in the south or were influenced by the Incas who had their capital in the southern highlands. These differences between alignments in the north and south may be more apparent than real (e.g. perhaps they are only a product of sampling), since we have good evidence that both Pleiades and zenith/anti-zenith alignments were incorporated in the Inca ceremonial architecture (Aveni, 1981; and Zuidema, 1981 and 1982) and in the agricultural and ritual calendars of the north coast (Urton, 1982).

We have suggested earlier that site orientations may have been

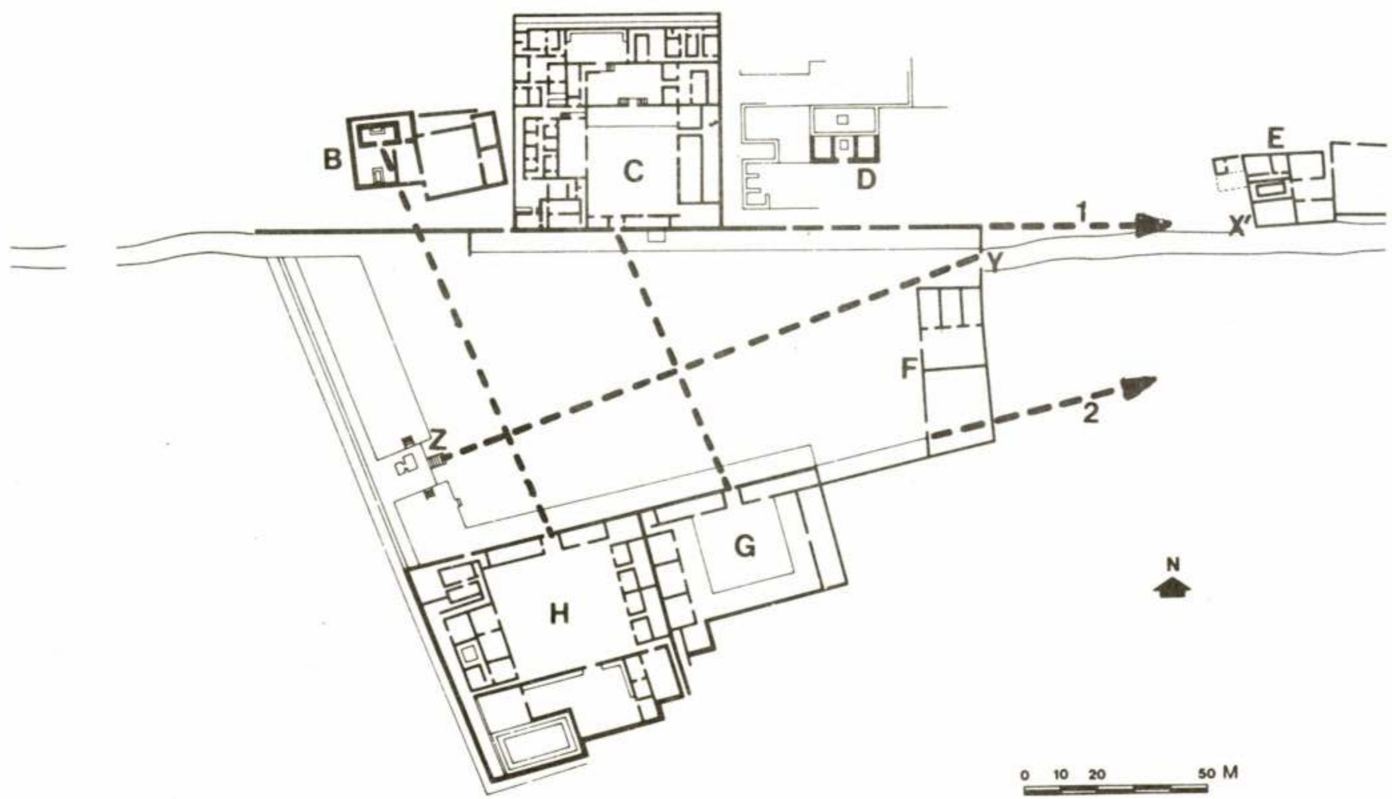

Fig. 2 Tambo Colorado (Plan after Harth-Terre (1938) reproduced in Gasparini and Margolies (1980) showing possible geometrical and astronomical influence in the arrangement of buildings (dotted lines added by the authors).

selected according to any number of astronomical or non-astronomical considerations. In this regard, it is of interest to discuss briefly the example provided by one site reported in Table 1: Tambo Colorado. Tambo Colorado was an Inca coastal site which incorporated at least one feature, an irregularly-shaped central plaza, which was not uncommon in other coastal and highland Inca sites (Fig.2). For instance, as Zuidema (p.c.) had suggested, the central plaza in the Inca capital city of Cuzco was composed of two adjacent plazas (divided by the Saphi River), which together exhibited an irregular shape not unlike that of Tambo Colorado. It has been shown that the arrangement of certain buildings within the central plaza of Cuzco was at least partially determined by an interest in orientation to the points on the horizon where the zenith sun rose and the anti-zenith sun set (Aveni, 1981; and Zuidema, 1981). At Tambo Colorado, the buildings along the northern border of the large central plaza called the "esplanade" (Harth-Terre, 1938) are aligned within $\frac{1}{2}^{\circ}$ of the orientation to the anti-zenith sunrise and the zenith sunset. While these astronomical orientations may have been important in the alignment of the buildings on the northern border of the plaza, it is possible that certain geometrical principles that yet remain to be discovered played a role in determining the overall deposition of buildings forming the four borders of the esplanade.

One curiosity about Tambo Colorado is that the quadrangular esplanade does not exhibit a single right angle. The absence of right angles, however, also may be more apparent than real if we consider the inter-relationship of other features among the borders of the plaza such as the altar which is inset on the west (Fig.2,Z), and the doorways of four buildings (Fig. 2B, C, G, H) which open onto the esplanade. The orientation of the altar (Z), in Fig.2, calculated on the basis of the two transit measurements taken on the facades of the northern and southern buildings of the esplanade, is $54\frac{1}{2}^{\circ}$. The eastward extension of this line of orientation passes less than 1° (or a $2\frac{1}{2}$ m. deviation over 155 m) to the north of the opening on the eastern side of the explanade (Fig. 2,Y). The north-eastern corner appears to have been the point where the old Inca road entered the esplanade.

If a line is extended between the doorways of buildings C and G, we find that the intersection of CG and ZY produces an angle of $88\frac{1}{2}^{\circ}$; furthermore, the point of intersection occurs in the middle of the esplanade. It is also of interest that the line CG is within $2\frac{1}{2}^{\circ}$ of parallel with the facade of the building which contains the altar (Z). Finally, a line extended between the doorways of buildings B and H lies within $3/4^{\circ}$ of the orientation of line CG and also crosses the line ZY at nearly a right angle. However, Hyslop (p.c.) suggests to us that structure B may date from an earlier period; therefore this line must be regarded as a bit more problematic than the others.

One can draw only the most tentative of conclusions when referring to a site map such as that reproduced in Fig.2; nonetheless, by combining such evidence with independent data, like the alignment readings provided in Table 1, it is possible to arrive at a number of creative and testable hypotheses. From the example

of Tambo Colorado, it would seem important to investigate more thoroughly the relationship between astronomical and non-astro-nomical (e.g. geometrical) principles of orientation and architectural planning in Inca and pre-Inca sites along the coast and in the sierra. The possibility of arranging structures in an apparently irregular fashion while incorporating a set of rigorous, underlying geometric principles, (e.g. describing right angles and parallel lines in the open spaces between structures) may not have been an uncommon architectural device in the Pre-Columbian world. This is suggested by the fact that the organisation of buildings at Tambo Colorado, and the "interstitial" geometry which results from that organisation, is very similar to that found in the famous Maya Nunnery at Uxmal (Aveni and Hartung, 1982).

We thank R. Feldman for providing us with more recent dates on the structures.

Table 1

	SITE [1]	LATITUDE (SOUTH)	DATE	HORIZON ELEVATION	ALIGNM. AZIMUTH	RECIPROCAL(R) OR PERPENDICULAR(P) ALIGNMENT	RISE/SET AZIMUTH OF PLEIADES FOR GIVEN DATE [2]	RISE/SET AZIMUTH OF SUN ON DAY OF: ZENITH PASSAGE [2]	ANTI-ZENITH PASSAGE [2]
1a	Batan Grande	6°30'	500A.D.	1°	17°26'	107°26'-287°26'(P)	288°32'		
1b	"	"	"	"	17°30'	107°30'-287°30'(P)	288°32'		
	"	"	1000A.D.	"	17°26'	107°26'-287°26'(P)	290°44'		
	"	"	"	"	17°30'	107°30'-287°30'(P)	290°44'		
2	Pacatnamú	7°30'	500A.D.	1°	202°40'	112°40'-292°40'(P)	288°33'		
	"	"	1000A.D.	"	"	"	290°45'		
3a	Huaca del Sol	8°10'	400A.D.	0°	296°34'	116°34'(hor.=11°)(R)			
3b	"	"	"	11°	24°38'	204°38'(hor.=0°)(R)			
4a	Huaca de la Luna	8°10'	200A.D.	0°	286°15'	106°15'(hor.=19°)(R)	287°00'		
4b	"	"	"	10°	26°05'	206°05'(hor.=1°)(R)			
5a	Huaca el Dragon	8°05'	1300A.D.	1°	289°12'	109°12'(hor.=3°)(R)			
5b	"	"	"	4°	16°43'	196°43'(hor.=0°)(R)			
5c	"	"	"	6°	287°57'	107°57'(hor.=6°)(R)			
	"	"	1000A.D.	"	"	"	290°38'		
6a	[3]Huaca La Esmeralda	8°05'	500A.D.	0°	104°50'	284°50'	288°26'		
6b	"	"	"	"	105°50'	285°50'	288°26'		
	"	"	1000A.D.	"	"	"	290°38'		
7a	Ciu. Tschudi	8°06'	1400A.D.	0°	110°43'	290°43(R)	292°20'		
7b	"	"	"	"	201°12'	21°12'(R)			
7c	"	"	"	"	16°51'	196°51'(R)			
	"	"	1500A.D.	"	"	"	292°36'		
8	C. Bandelier	8°06'	1350A.D.	0°	22°10'	112°10'-292°10'(P)	291°28'		
9	C. Sechin	9°30'	800B.C.	2°	278°48'	98°48'(R)		99°22'	
10a	Chavin	9°34'	500B.C.	3°	13°16'	193°16(R)			
10b	"	"	"	3°	13°29'	193°29'(R)			
10c				23°	293°28'	103°28'(R)	289°08'		
10d				23°	283°35'	103°35'(R)	289°08'		
11a	Paramonga	10°40'	1000A.D.	0°	256°49'	76°49'(R)		259°00'[4]	79°00'[4]
11b	"	"	1500A.D.	"	"	"		"	"
12a	Tambo Colorado	14°26'	1500A.D.	2°	75°52'	255°52'(R)		255°25'	75°25'
12b	"	"	"	"	60°39'	240°39'(R)			
13a	Cahuachi	14°42'	300A.D.	0°-3°	2°16'	357°44'(R)			
13b	"				103°35'	283°35'(R)		104°15 105°08'	284°15' 285°08'
13c	"				91°	271°(R)			
13d	"				7°55'	352°5'(R)			
14	Huaca del Loro	14°42'	500A.D.	3°	79°03'	58°-79°'3(range)68°30'(center)	70°15'		75°25'

NOTES TO TABLE

1) Descriptions of site locations, the specific features measured and any additional comments are provided in the Appendix.

2) All astronomical matches were derived from the tables of (Aveni, 1972). They are corrected for horizon elevation. General agreement between azimuth of alignment and astronomical event is indicated by underlining the azimuths.

3) Readings at Huaca La Esmeralda were made with a hand-held magnetic compass. The magnetic readings were then corrected by a correction factor (+3°20') determined by comparing magnetic and true azimuths determined on the same feature at several different sites near Huaca la Esmeralda in the Moche valley.

4) Unlike the case for stellar alignments, the azimuth of sunrise and sunset remains relatively constant over long periods of time.

APPENDIX

The number entries in this appendix coincide with the numbers to the far left in table 1.

1a - Wall 1, East Side, Las Ventanas Pyramid. We are grateful to Izumi Shimada of Princeton University for permitting us access to the site and for advising us on where to make measurements.

1b - Wall 1, East Side, Las Ventanas Pyramid.

2 - West wall of unidentified building giving typical site orientation; looking south.

3a - Exposed row of adobe blocks along the southern edge of the upper platform.

3b - Exposed row of adobe blocks, roughly perpendicular to 3a, along the upper platform.

4a - Adobe foundation blocks of a structure on the upper platform of the large westernmost section of the Huaca.

4b - Adobe foundation blocks of a wall perpendicular to the wall described in 4a, and part of the same structure.

5a - The north exterior compound wall.

5b - The west exterior compound wall.

5c - The north wall of the interior platform.

6a - Edge of north wall of the platform.

6b - The east-west "passageway" dividing the platform of Huaca La Esmeralda into two sections.

7a - The western section of the north exterior compound wall (for maps of Cuidadela Tschudi and Ciudadela Bandelier, see Moseley and Mackey, 1974).

7b - The west exterior compound wall.

7c - The west exterior wall of the "Gran Plaza Ceremonial"; the first major plaza upon entering the cuidadela.

8 - The northwest exterior compound wall.

9 - The elaborately carved, north exterior wall (see Tello, 1956).

10a - Northward along the eastern side of the Block and

White Portal (see the map of Chavin de Huantar in Rowe, 1962).

10b - The east wall of the large sunken square courtyard to the east of the New Temple.

10c - The west wall of the large sunken square courtyard to the east of the New Temple.

10d - Westward up the stairway leading from the sunken circular courtyard to the Old Temple (see map in Llosa 1972).

11 - South wall of structure, uppermost portion; looking east.

12a - The south wall of the central building bordering the main plaza on the north; looking east (see map in Harthe-Terre, 1973).

12b - The north wall of the central building bordering the main plaza on the southeast; looking east.

13a - Exposed stucco-covered rubble wall along the eastern edge of a large mound in the northwestern quadrant of the site (see map by W. Strong, 1957).

13b - The north face of the central platform of a platform mound located north of the "Great Temple" (Strong map).

13c - Foundation along the northern edge of a lower platform of the "Great Temple".

13d - Foundation along the western edge of a lower platform of the "Great Temple".

14 - From the centre of the Round Temple to the southern edge of the doorway (see Paulsen, n.d.: Fig.3).

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R.T. ZUIDEMA

Towards a General Andean Star Calendar in Ancient Peru

In two recent articles (Zuidema 1982a, 1982b), discussing the calendar of the Incas in Cuzco at the time of the Spanish conquest ($\pm$ 1530), I concentrated in my analysis on two groups of constellations. The first group consisted of the Pleiades, considered as the mother of all other stars and constellations. The other group was formed of four constellations. The first of these was a dark-cloud constellation-- interstellar dust within the Milky Way-- representing a llama; also called in the province of Huarochiri in Central Peru, Yacana. The eyes of the llama, known today as llamac ñawin (Cuzco) or llamapa ñawin (Ayacucho) "eyes of the Llama," were formed by the stars Alpha and Beta Centauri. The Llama stretches toward the east behind these two stars. The third constellation, called Yutu-- yutu, a tinamou bird or, in present-day Spanish, a "partridge"-- was represented, then and today, by the constellation known in Western astronomy as the "coalsack." Finally, the fourth constellation-- but here our knowledge is less definitive for the sixteenth century-- is the Southern Cross, within which that of the Yutu as a dark-cloud constellation is found. I will refer to the Southern Cross by this Western name and accept that its astronomical calendrical function coincides with that of the Yutu.

The Incas established a correlation between the period of visibility of the Pleiades and that of a period of 328 nights, beginning with the first heliacal rise in the morning of the Pleiades (9 June) and ending on 3 May, some two weeks after their last heliacal set in the evening. The period of 328 nights, although based on a sidereal-lunar calculation ($12 \times 27^1/3 = 328$), was used, first of all, for measuring periods of unequal length in between succeeding astronomical observations in which the Incas were interested. These observations were, for instance, the heliacal rises and sets of stars, the sunrises and sets during the solstices, the sunrises when the sun goes through the zenith (zenith sunrises on 30 October and 13 February), sunsets when the sun goes through the nadir (antizenith sunsets on 18 August and 25 April) and periods within the year equal to either a synodic month (29 or 30 nights) or a sidereal month (rounded off to 28 nights). Another use, combined with the former, was, however, defining longer or shorter calendrical periods in terms of the socio-political hierarchy of Cuzco and its valley. The period of 37 days from May 3 to June 9 was not measured by way of this calendar. One contribution of this article will be to clarify the Andean interest in this period; a period to which I have already given some attention in a third article (Zuidema Ms.).

The Incas, and probably people of Southern Peru and Northern Bolivia in general, observed a spatial opposition in the sky of the Pleiades, on the one hand, and the group of the four constellations, on the other. Thus, while the llama constellation or that of its eyes was known under one name as catachillay, the Pleiades were called by one of their names, catachillay huarahuara, "the stars catachillay." The calendrical positions of both groups of constellations were defined more precisely within the 328-night calendar. The Incas recognised the following periods belonging to this calendar in relation to their observations of the Pleiades, the Yutu and Llamapa ñawin (Note 1):

CALENDAR	ASTRONOMICAL OBSERVATION
3 September - 30 September	Period of lower culmination of Yutu (3 September - 29 September)
1 October - 30 October	Period of lower culmination of Llamapa ñawin (7 October-2 November)
1 November - 21 November	Period of upper culmination of the Pleiades (5 November - 18 November)

Chroniclers inform us in general terms that, except for the Pleiades which were worshipped by all people, other stars and constellations were worshipped by specific social groups during their period of upper culmination. These groups could be either kin groups, groups of a special social rank, or professional groups. The example of the Southern Cross and Alpha and Beta Centauri shows that stars or constellations could be worshipped also during their times of lower culmination. The practical use of combining the observations of upper and lower culminations in our example was that the spatial opposition of the two groups of constellations was defined more sharply by way of a calendrical contiguity between the lower culmination of the Southern Cross and Alpha and Beta Centauri and the upper culmination of the Pleiades.

One question to be answered in this paper is the following. Given the data on the relationship mentioned, how was the other relationship expressed, the one between the lower culmination of the Pleiades and the upper culminations of the Southern Cross (Yutu) and Alpha and Beta Centauri (Llamapa ñawin)? Our data from Cuzco and Huarochiri clarified Andean concepts concerning the period of lower culmination of the Pleiades. In Cuzco, the Incas established a calendrical connection between the heliacal rise in the morning of the Pleiades (9 June) and the June solstice (21 June) and a similar one between the heliacal set in the evening ($\pm$ 15 April) and antizenith sunset (25 April). In Huarochiri I argued that a feast, celebrated three times a year, also was timed to the Pleiades. The first feast, correlating the disappearance of the Pleiades with antizenith sunset (22 April, at the latitude of Huarochiri, 12° south of the Equator), celebrated the death and resurrection of the Thunder god, called Yaro or Pariacaca. He was addressed as "our father" and was supposed to live in the snow-capped mountains of Pariacaca. The second feast, at the time of the reappearance of the Pleiades, was in honor of a female deity,

Chaupiñamca, addressed as "our mother." She was identified with Pachamama, "mother Earth." The third feast, in colonial times celebrated close to that of San Andrés (30 November), probably was timed to the first heliacal set in the evening of the Pleiades (18 November; or 21 November in the Inca calendar).

The new data to be analyzed in this paper seem to tell us more about the upper culmination of the Southern Cross in March; it is found in documents of a certain type-- those on the extirpation of idolatries-- that are particularly rich for various villages at the latitude of 11° south of the Equator. Historical legends support their cultural unity, the region stretching over all the mountain chains at this latitude. Their mythology centers on the rejuvenation within five days of the Thunder god; an event probably timed to the antizenith sunset at this latitude on 19 April.

With the analysis of these new data, I hope to contribute to the solution of a specific problem concerning the simultaneous use in Cuzco of a solar year count, of a count using synodic lunar months and of the 328-night count. The problem becomes acute if we study calendrical oppositions like those of the solstices and those of the zenith and antizenith sunrises and sunsets. Each opposition divided the solar year into two half-years. Other oppositions, like those of the constellations discussed above, could not divide the year exactly into two half-years. All this information had to be recorded, however, by a calendrical system, that of the 328-night count, that occupied an irregular place within the solar year. I will suggest in the third section in schematic form how the Incas managed to keep a certain correspondence between the three counts, a correspondence to be argued in the fourth and fifth sections.

The solar year count

Before doing this, however, I shall have to analyze one other corpus of data from Cuzco, one that refers exclusively to the calendrical count of the solar year. The early chronicler Polo de Ondegardo (Polo 1916: 18-24), who recorded also the 328-night count, tells us that the Incas divided the solar year into 12 parts, accomplishing this by adding one or two days to certain synodic lunar months. The consequence of such a procedure is, of course, a complete detachment of this type of calendar from the count of synodic lunar months of 29 or 30 days each. Two other chroniclers have similar data. Betanzos (1968: ch. 18), in 1551, refers to a year of 360 (12 x 30) days, plus 5 extra days. The late indigenous chronicler, Felipe Guaman Poma de Ayala (1980: 260/62), in ± 1615, probably copying Polo, mentions months of 30 days, with weeks of 10 days, months to which one or two days could be added. If such a calendar existed, next to the 328-night count, then it was probably calculated taking into account the division of the year by way of the solstices and the equinoxes. We shall recognize an effort of the 328-night count and of the synodic lunar calendar to give these divisions of the solar year a significant place in their own systems.

The cultural and social expression of the solar year was carried out by way of the following system of llama sacrifices. Llamas were dedicated, either to the god Viracocha, identified by the Spaniards as the Creator god, or to the Sun god, or to the Thunder god. Guanacos, wild llamas, being described as brown, were dedicated to Viracocha. White, woolly llamas belonged to the Sun god and llamas with hair of different colors, that is probably alpacas, belonged to the Thunder god. Polo de Ondegardo and the chroniclers who followed his description (Acosta, Cabello Valboa, Murua, Guaman Poma and Cobo) mention that in each month one hundred llamas of one class were sacrificed. For reasons to be explained in a moment, I conclude that, when Polo talks about the month of June, he means the period of 30 or 31 days ending at the June solstice, according to the system set out in Table 1.

It is difficult to imagine that a system with diametric oppositions, like that expressed here, could exist in any other way than in a count of the solar year of 365 or 366 days. The months around the solstices oppose to each other llamas of the same category: guanacos or wild llamas. The months around the equinoxes represent a more complicated system. The fourth and tenth months involve a color opposition: sacrifices of white llamas in the fourth and those of black llamas in the tenth. Additional data on the other two equinoctial months support this conclusion and allow us to lead this discussion into an astronomical one. In October, the fifth month, a black llama was bound in the plaza to a pole, depriving it of food and water, in order to make it "weep for rain." From that time on, rains were expected to come for the crops, especially the one of maize, that were planted from August (early planting) and September (general planting) onwards. In April, the eleventh month, a white llama was bound to a pole in the plaza, a llama that was fed chicha (maize beer) and that was expected to kick over a vessel containing beer with its feet. Here the reference was to the repair of irrigation canals, needed after the time of heavy rains. A ritual race, carried out from a mountain called Anahuarque, enabled me to connect the ritual of the black llama to calendrical considerations concerning the black llama in the sky. As this constellation has its period of lower culmination in October, that is its disappearance during part of the night, we can suggest that the ritual of the black llama in October referred to the period of lower culmination of the celestial llama and the one of the white llama in April to that of its upper culmination.

As the sacrifices of the guanacos and of the white llamas were grouped into three seasons of three months each, we are presented with the suggestion that the sacrifices of black llamas in March, the tenth month, and those of different colours in the eleventh and twelfth months also belonged to one season. The question therefore becomes: is there a reason to oppose this whole group to that of the white woolly llamas, sacrificed in the fourth, fifth and sixth months? Although the rituals in these months include a strong female connotation, it was the time when the sun grew stronger, sending not only heat, but also rain to make the plants grow (see, e.g., Guaman Poma 1980: 885/99). Priests called Tarpuntay-- from tarpuy, "to plant"; being priests, however, dedicated to the

Table 1 Llamas and the solar year

	The description of the chroniclers.	My interpretation of their data.	month names in chronicles.	my interpretation of these months.
1)	guanacos, brown, living in the high mountains.	Guanacos (wild	June	Months around
2)	brown, color of vizcacha, yahuarchumbi (reddish brown).	llamas) dedicated	July	June solstice
3)	brown, without any spot, chestnut, color of vizcacha.	to Viracocha.	August	and month after.
4)	white, woolly	White woolly	September	Months around
5)	of the same	llamas dedicated	October	Sept. equinox
6)	of the same	to Sun god.	November	and month after.
7)	large llamas	Guanacos	December	Months around
8)	brown, of a light color and white head and knees.	dedicated to	January	Dec. solstice
9)	like the other months, chestnut color.	Viracocha.	February	and month after.
10)	black.	Llamas or alpacas	March	Months around
11)	moromoro, "pintado", spotted, of different colors.	dedicated to	April	March equinox
12)	" " "	Thundergod.	May	and month after.

Table 2 Solar-lunar correlations in Cuzco

June solstice (JS, 21 June)	full moon
sun in nadir; antizenith sunset (AZSS, 18 August)	full moon
September equinox (21 September)	full moon (17 September)
sun in zenith; zenith sunrise (ZSR, 30 October)	new moon
December solstice (DS, 21 December)	new moon (28 December)
sun in zenith; zenith sunrise (ZSR, 13 February)	full moon (11 February)
March equinox (21 March)	full moon (12 March)
sun in nadir; antizenith sunset (AZSS, 25 April)	new moon

Sun-- had to fast for two months until the maize plants were grown two hands high. While these months expressed a connotation of increase of the Sun, those around the solstices were more neutrally defined. During the first three months (June to August) the earth was dry, cold and without crops. From the seventh to the ninth month (December to February) the rains were too strong for their waters to be contained within irrigation canals. Therefore, maize plants already had to be strong enough to withstand the destructive forces of nature by themselves and without the help of man. In March, the tenth month, people started their first actions to regulate again the water received from heaven. In Huarochiri, they would go up to the mountain lakes to see the level of water there. They would then close the overflows to the irrigation canals (Avila 1980: ch. 31). We can interpret the sacrifice in Cuzco of the black llamas in the same month against the background of this practice and against that of the general concern with water from October to March. In October the black llama was starved but not killed. In January, during the heavy rains, people would go out into the mountains around the town, weeping and doing penance just as they forced the llamas to do. There would be less food. Vegetables, eaten then, occasioned inflated stomachs and death. But in March the first potatoes and maize arrived and vegetables were good to eat. Guaman Poma (1980: 240/242; 241/243) mentions specifically how it was that the high priests and the other priests performed the sacrifices dedicating the hundred black llamas to all the mountains that were recognized by the king to be worshipped. The intention of killing the black llamas apparently was to induce the end of the rainy season, a period that had been called up initially by making black llamas weep.

In this context, Guaman Poma gives us a precious clue of how to include the political function of the 328-night count within the solar year. The high priests in Cuzco were descendants of the legendary king Viracocha Inca, the king who derived his name from the "creator" god Viracocha. This group of descendants was called Sucsu, a name referring to a sickly and consumptive condition, a discolored and yellowish complexion and to a shrunken body or shrunken arms and legs. I will analyze in another article the myths related to this condition. We can, however, already suggest the interpretation that it was the group Sucsu, with the high priest belonging to it, who was in charge of the month of March, ending the period of sickness and introducing the two months of harvest. Calendrically, the group of Sucsu was in charge of period III in the 328-night count (as I reconstructed its place within the solar year), from 14 February to 17 March. This period corresponds closely to that of the tenth month in the solar year count, going from 19 February to 20 March. The data from the 328-night count and the solar year confirm each other in this case. (For the technical details of the 328-night count and the place of Sucsu, see the third section.)

As was mentioned before, llamas with wool of different colors, sacrificed in April and May, were dedicated to the Thunder god. The data from the documents on the extirpation of idolatries will tell us more about the calendrical association. However, the myth from Huarochiri on the celestial black llama also has specific

details on llama wool of various colours. These details can clarify not only the information on April and May, but also certain other information of Polo de Ondegardo on the celestial llama and her family.

In my first reading of this myth from Huarochiri, I paid special attention to its first part (Zuidema and Urton 1976). The llama drinks the waters of the earth, saving it from the Flood, in the middle of the night, when nobody sees her. She suckles her baby-- a dark-cloud constellation just below her-- when she, but not the baby, has already risen. By comparing this information with that from Cuzco, I reached the interpretation that the myth discusses the periods of lower culmination of the llama and that of her baby. The myth also says, however, that sometimes, when she drinks the water from all the springs, she falls on top of a man, probably one sleeping in the fields next to a spring. Such a man was considered lucky as he would be covered completely with wool. Other men would shear the wool, this happening during the night. In the morning they would discover that the wool was of various colours: blue, white, black and brown, all colours mixed. If the lucky man had no llamas then he would immediately buy two, a male and a female, and these would bear him a herd of two to three thousand llamas. He would give cult to the wool where he had seen the celestial llama (the Yacana) and where his friends had sheared the wool.

We can search in two directions for an interpretation of this part of the myth in terms of the Inca calendar. The first interpretation relates it to the December solstice, and to the full moon after. On the day of the December solstice, the noble boys of Cuzco finished the rituals initiating them into manhood by going into a cultivated field near a source of water and having their ears pierced, an act for boys the timing of which was tied to the first menstruation of girls as their initiation into womanhood. On the next day, the priests of the "creator," the Sun, the Thunder and the Moon, together with the herders of the king, began the feasts of multiplication, counting the llamas belonging to these gods and to the king. During the next full moon, men and women-- those who were rich owners of llama herds and the parents of the recently initiated boys-- took up a rope made of wool of four colors: white, black, red and yellowish brown, a rope that represented a llama. They danced around the king in the plaza, leaving the rope at the end in a spiral around him. The colours of the rope, symbolizing a llama, suggest those of the wool given by the celestial llama to future, prosperous owners of llamas. The connection of the initiation rituals to the counting of llamas suggests, moreover, an initiation of boys into economic prosperity by obtaining llama herds.

But this second part of the myth from Huarochiri can be understood also in terms of the llama sacrifices during the period from the tenth to the twelfth month (March to May). The celestial llama drinks the waters of the earth, preventing the Flood. The act does not seem necessary in October, but it is in March. Going from sacrifices of black llamas in March to sacrifices of llamas of different colors in April and May could reflect the bestowal of wool

of different colors by the celestial black llama. The myth speaks of a change from night to day, but it symbolizes a change from wet season-- when during six months, from October to March, black llamas were important and when, moreover, black llamas, black dogs and people wept-- into dry season around the March equinox.

This second interpretation is probably not in conflict with the first. It leads, however, to further astronomical consequences, if one compares the data from Huarochiri with those of Polo de Ondegardo from Cuzco and those of Bertonio from Lake Titicaca. Every author gives the celestial llama a kid that we can recognise as a dark-cloud constellation near his mother. But while Bertonio calls the young llama unuchillay (unu, "young"), Polo (1916: 3-4) mentions also the star Vega in the constellation of Lyra as husband of the black celestial llama. Moreover, he gives the father and young llama the same name, urcochillay; urco meaning male, specifically male llama. Vega was a male llama of different colors, worshipped by owners of llamas and, probably, by their sons aiming to obtain a herd. If the information of Polo can be trusted-- it is not confirmed by any author independently of him-- it could express the astronomical relation between Alpha and Beta Centauri and Vega as the eyes of the female llama and the male llama respectively. Vega has its heliacal rise in the morning during the beginning of February. That is, it occurs just after the days when the ritual with the multicolored llama rope was executed on a night of full moon following 28 December. (See section III for the 328-night count; such a full moon could occur between 28 December and 27 January). In February, when Vega rises heliacally in the morning, Alpha and Beta Centauri have their upper culmination at midnight and Vega rises at the same hour. The upper culmination of Vega at midnight is around the June solstice. This fact may have been significant. While, on the one hand, Polo de Ondegardo mentions the sacrifices of the one hundred guanacos in the months of the solar year count before and after the June solstice, Molina, on the other, in his description of the celebration of the June solstice itself during the synodic lunar month of Intiraymi-- a month that could occur from 27 days before to 27 days after the day of the June solstice-- gives a list of llamas of different colors which were then sacrificed, probably in addition to the one hundred guanacos.

I wish to end the first part of this paper with three observations:

1) Polo said that llamas of different colours were sacrificed to the Thunder god in order "that there be no lack of rain." We discovered that their role in the calendar was of a far more complex nature. They were sacrificed within the regular system of sacrificing one hundred llamas a month, when the Sun was losing strength, during the two months beginning the half year related to the dry season. The dry season was needed for harvest, for the drying and conservation of different foods, for travel and for warfare. Nonetheless, there remained during this time a positive interest in water. The irrigation canals were rebuilt, ensuring that during next year's agricultural cycle water would not be lacking. During these months, when the forces of the sun were

failing rapidly, the task of regenerating the year was given to the Thunder god, at a time before the actual new agricultural cycle had started. The myths to be dealt with next explain how this role of the Thunder god was represented.

2) The diametrical oppositions as discussed here in the context of the calendar-round of the solar year; the opposition of black to multicolored llamas in terms of calendrical contiguity around the March equinox; and the fact that llamas and men were made to weep during six continuous months and not in the other months make it imperative to think of these oppositions in terms of the solar year cycle, divided by the solstices and equinoxes. But do we have evidence, other than this interpretation of data from the Spanish chroniclers, to support such a claim for a division of the solar year into periods of 30 or 31 days? In 1977 I published a photograph, with analysis, of a pre-Inca textile representing a calendar of 12 months of 360 days with 5 extra days. Therefore, not only did this type of calendrical structure exist in pre-Spanish times, but it also carried out a regular repetitive count of the days of a solar year as distinguished from the counting of irregular calendrical distances between various astronomical observations, as was done with the help of the 328-night count. The solar year count apparently had a base also in astronomical observation. Along with observing sunrise and sunset during the December solstice and sunset during the June solstice, the Incas made important astronomical observations of sunrise 30 days before and 30 days after the June solstice (see Note 2). In addition to these observations, the 328-night count recognized the date of 21 November, that is 30 nights before the December solstice, as the beginning date of its second half-year period. These dates, then, had a significant place in the count of the solar year in terms of months with 30 or 31 days.

3) The celestial llama had its period of lower culmination between about 7 October and 2 November and that of its upper culmination around 20 April. The myth of the celestial black llama itself, however, has no reference to the Thunder god, nor to his relation with the wool of different colors that she gave. Moreover, neither the mythology of Huarochiri, nor that of Cuzco, has given us any clue to the constellation of the Yutu, the "partridge," although its period of culmination around 25 March covers part of the time when llamas of different colors were sacrificed, that is the time from 21 March to 21 May. The myths recorded in the documents on idolatries assist us on this point: they discuss the connection between a Yutu that is probably celestial and the Thunder god.

The three calendrical counts

This paper is primarily concerned with testing the three calendrical counts-- from Cuzco and elsewhere-- against each other in their parts corresponding to the months from March to May. I shall mention first the place of these counts in the year as suggested in my earlier articles and indicate the type of information that is used in support of each. This overview

enables me to define my terminology.

The solar year count

The year was divided into 12 months of 30 days, 36 weeks of 10 days, and 5 or 6 days extra, added either intermittently after certain months or at the end of the year. The most important data on these months are found in the system of llama sacrifices, one hundred llamas in each month. These data on llamas are described in the chronicles by way of the months of the western calendar. We have to disentangle, therefore, data referring to the months of the Inca solar year from those referring to the Western calendar and those referring to the synodic lunar months. The count of the four seasons of the solar year started 30 or 31 days before each solstice and before two dates close to each equinox, respectively (see Table 1).

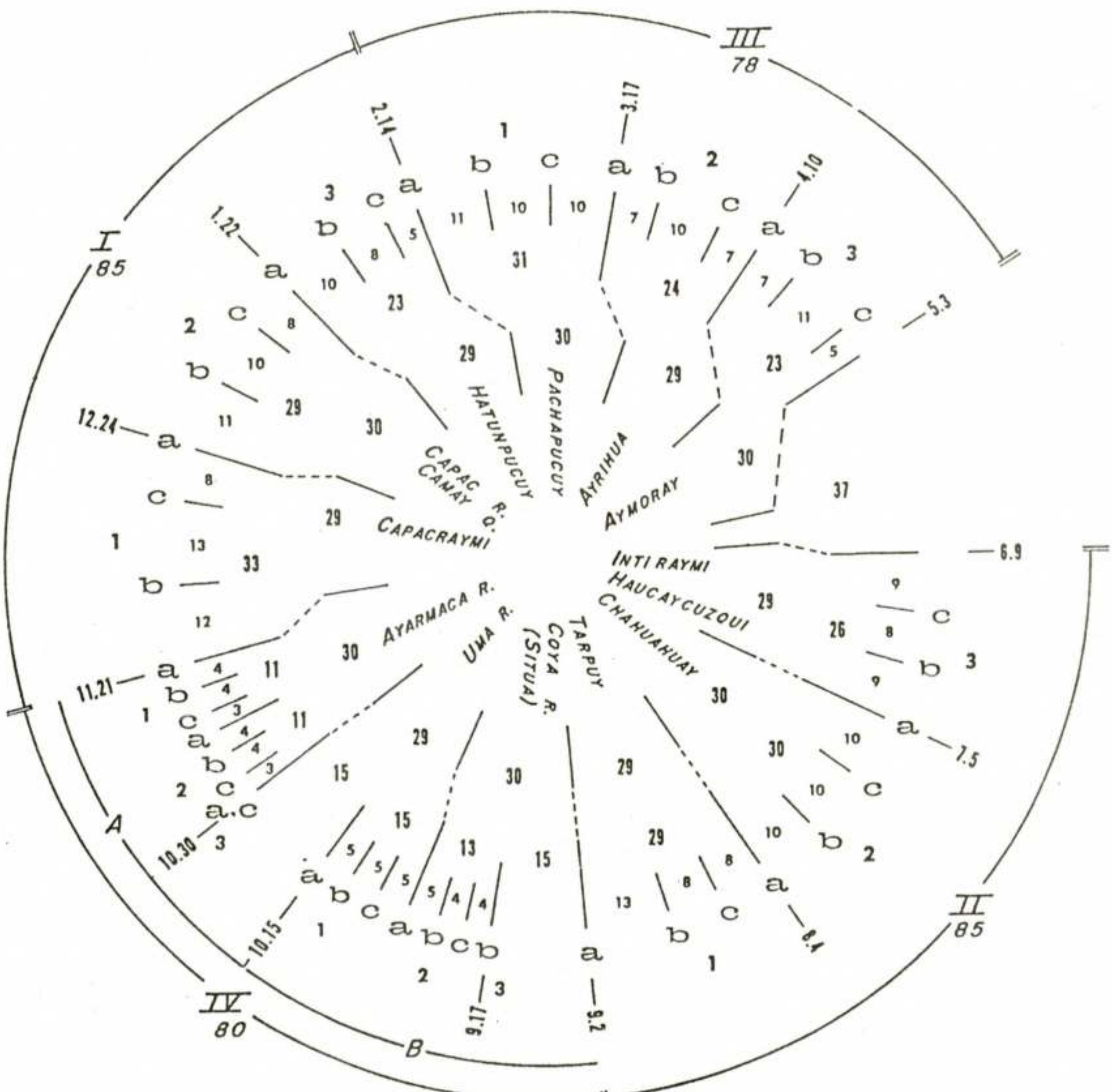
The synodic lunar month count

The correlation of this count to that of the solar year was established by taking the lunar month including the June solstice as the first of 12 lunar months. The average, and ideal, correlation was having a full moon during the June solstice, 21 June. This average synodic lunar calendar started on the night of the first visible moon, that is 9 June, some 17 days after the beginning date of the solar year, 23 May. The latter date helped to define the earliest possible date of a new moon in the movable synodic lunar count, 25 May. The synodic lunar count is eleven and a quarter days shorter than the solar year count. The information on the synodic lunar months is given mostly in descriptions of the agricultural system and of the feasts celebrating events of the solar year on either a full or a new moon. The associations which the Incas observed in Cuzco between their average synodic lunar month count and events of the solar year are shown in Table 2. (Table 3 gives the names of the months). I have added the equinoxes to this list, although I do not have information of a correlation with the moon in their case. The data on the feast of <u>Coya raymi</u> do, however, suggest such a correlation.

The sidereal lunar calendar

Although closely related to the 328-night count, the sidereal lunar calendar has to be distinguished separately, in a way somewhat similar to the difference between the solar year count and the synodic lunar month count. The sidereal lunar calendar can be understood best as being based on the observation of 8 periods of 41 nights, each period being one and a half sidereal months of twenty-seven and one third nights. As an inversion of this calendar, and thus as another expression of the same, the Incas had a calendar of 41 weeks of 8 nights. As against the solar year calendar with male associations, the sidereal lunar calendar had a female character. The count of this calendar started with the heliacal rise in the

Table 3 The political organization of Cuzco



morning of the Pleiades, together with the first new moon of the average synodic lunar month count, timed to 9 June. Apparently, the 37 nights between 3 May, the end of the sidereal lunar calendar, and 9 June were not counted in this system.

The ceque system as a system of astronomical observation

The ceque system consisted of 41 directions, radiating out from the central Temple of the Sun in Cuzco. Comparison with other similar systems in Andean towns suggests that the number 41 was a constant, but that the directions were not exactly alike in each local context. We can compare the ceque system best to a concentric system of coordinates describing space around Cuzco. Certain points on the horizon, indicated by way of ceques, were also used for astronomical observation. But only two of the places used to observe specific sunrises or sunsets coincided with the Temple of the Sun in making their observation along a ceque.

The 328-night count

By way of recognizing certain locations along each ceque and defining the number of locations admitted to each, a calendrical sequence was built up, worshipping each location following a daily order. A location, considered as huaca, "sacred place," because of its inclusion in the ceque system might have no importance other than in the calendrical sequence it helped to build. The role of a ceque in the total of 41 is indicated by the combination of a Roman numeral (I, II, III or IV), an Arabic number (1, 2 or 3), and a letter (a, b or c). Each combination serves also two calendrical functions: one, for defining a date in the 328-night count and another for defining a period in relation to a date. In II and IV the period is that of the number of nights before the corresponding date. In I and III it is that after the corresponding date. The context of the argument makes clear which use is made of a certain combination (see Table 3). In the political organisation of Cuzco, ritual functions in relation to the huacas of a ceque were taken care of by a group of people living in the direction of that ceque. I have described elsewhere this system of 10 royal ayllus or panacas, of 10 non-royal ayllus, and of certain non-Inca villages organized around the two other towns of the valley of Cuzco: Sañu (today called San Sebastián) and Oma (today called San Jerónimo). In terms of these data on social organization, IV is different from I, II and III. We have little data on the panacas and ayllus associated with IV. Their places are taken over by the Queen and women of the valley as one group, and by the villages of Sañu and Oma. Sañu was divided into the groups Sañu and Ayarmaca-- groups that still exist today as moieties in San Sebastián-- and the hamlets of Yacanora and Cari (see Table 4).

Table 4 The association of a legendary king, panaca, and non-royal ayllu to one group of 3 ceques (note exception in IV)

Group of 3 ceques	King	Panaca	non-royal ayllu	Calendrical association
II 3	Lloque Yupanqui 3rd king	Haquayni	Cuycusa or Aquiniaylla	9 June - 5 July
II 2	Capac Yupanqui 5th king	Apu mayta	Maras	6 July - 4 Aug.
II 1	Mayta Capac 4th king	Uscamayta	Sutic	5 Aug. - 2 Sept.
IV_B 3 b, 2		Queen	women	3 Sept. - 30 Sept.
IV_B 1, IV_A 3 a,c			village of Uma	1 Oct. - 30 Oct.
IV_A 2, 1			(moiety) Ayarmaca, village of Sañu	1 Nov. - 21 Nov.
I 1	Tupa Yupanqui 10th king	Capac ayllu	Chavin cuzco	21 Nov. - 23 Dec.
I 2	Pachacuti Inca 9th king	Iñaca p., Arayraca ayllu, Hatun ayllu Cuzco callan.		24 Dec. - 21 Jan.
I 3	Inca Roca 6th king	Vicaquirao	Huacaytaqui	22 Jan. - 13 Feb.
III 1	Viracocha Inca 8th king	Sucsu	Tarpuntay	14 Feb. - 16 March
III 2	Yahuar Huacac 7th king	Aucaylli	Sañu (probably moiety Sañu of village Sañu)	17 March - 9 April
III 3 a b c			Yacanora Ayarmaca Cari	10 April - 3 May

The myths from the province of Chinchaycocha (Lake Junín) and from the village of Hacas, province of Cajatambo

The first myth, from the area of Chinchaycocha, today called Lake Junín, deals with the adventures of a sacred mountain, Tumayricapa-- also known from another source in the XVIth century (Albornoz 1967: 30)-- who was widely worshipped as a god of strength, industry, fire and luck. The character of the myth demonstrates that we can consider him as the god of Thunder. Duviols (1974-76: 289), who published and analyzed the small chronicle in which this myth is found, registered from present-day inhabitants of the area a modern version of the myth. I shall refer to this version only in passing, interesting as it is, where it helps to place the older myth calendrically. The modern version mentions also a female deity known in the myth from Hacas, establishing a connection between the older myths and the villages where they are told. Duviols argues for this connection on other grounds also.

The myth from Chinchaycocha (Duviols 1974-76: 275-78) tells how Tumayricapa, together with his brother (who disappears immediately), came down to earth near Chinchaycocha on a mountain called Mamallqui jirca; a name that the document translates as "plant, beginning or origin of the mountains." There he called together all the Huacas, the sacred places. He went on to Bombon, a plain 10 to 15 kms away, and changed himself into a richly dressed child. A woman from the nearby village of Huaychau heard the child crying and brought it to her village and gave it the breast. Her name was Pullucchacua, interpreted by the document as "skin of the partridge," that is "skin of the bird without its feathers." Tumayricapa grew up within 5 days to be a strong man. He called together two other snow-covered mountains from either side of the valley. With them and with the other mountains and Huacas he organized a communal hunt of vicuñas in the plain of Uirapampa, close to Bombon. One mountain, Quirmuchan, wanted to grow higher than Tumayricapa, but the latter defeated him bringing him down with his rivi, a boleadora of which the three lead bullets had been replaced by three heavy rocks. Quirmuchan is now a low ridge of stones that divides the plain into two parts.

Concentrating my analysis of the myth only upon certain elements, two female roles are identified as mother to Tumayricapa. The first, who bore him, can probably be identified with Mamallqui jirca. The translation of "plant, beginning, origin" refers correctly to the word Mallqui. As the text mentions mamallqui, we might consider this word as a contraction of mama, "mother" and mallqui "plant of origin," a plant in this case specified as "motherplant," "origin of the mountains" like Tumayricapa and the other mountains referred to. The second mother-role is occupied by a woman who, because of her name, can be identified as a species of Yutu, the tinamou. Various details of the myth, like that of rebirth or rejuvenation, Tumayricapa as twin brother, the chaco or communal hunt and that of the fight using the boleadoras, will allow us to connect the myth, first, to the time of the passage of the sun through the nadir, when it sets at its antizenith point of 19 April at the latitude at the latitude of Chinchaycocha, and,

second, to the time represented in the Inca calendar by the eleventh and twelfth solar months, the months of April and May around the date of 19 April. But in order to come to an identification of the woman Pullucchacua, I shall pass first to the myth from Hacas. The document where this myth is found belongs to a group describing the idolatries of three villages close to each other: Ocros, Chilca and Hacas (Duviols 1971: 367-86; Huertas 1981: 50-59, 75-82 and 104-19).

The myth from Hacas, retold various times, explains a ritual carried out at a time specified calendrically in the following ways:

1) when people plow their fields; that is

2) when the rains stop (and when the water in the rivers diminishes);

3) at the time on or after Easter;

4) when people execute the dances of aylli aylli and ayrihua.

For the ritual, people catch the yucyuc, a bird with yellow beak and legs, dress him in a shirt and shouldercloth, carry him around with girls following him, singing and playing small drums. People offer sacrifices, thanking him for the cultivated plants that he has bestowed on them. The myth tells how these plants had belonged to a woman called Mama Rayguana, "mother Rayguana." An eagle, a fly catcher and the yucyuc stole, by a ruse, her baby, a baby which was a conopa, a stone protecting cultivated plants. In exchange for getting her child back, she gave up the plants: highland plants like potatoes etc. for the people living there and lowland plants like maize etc. for the people on the coast. Although the myth does not make it completely clear, we may conclude that the highland people received their plants through the yucyuc and the lowland people theirs through the flycatcher.

The description given of the yucyuc in the text does not allow us to identify with confidence the species of the bird. However, the Description of the West Indies of 1629 by Vázquez de Espinosa (1942: para. 1738) mentions that on the northcoast of Peru there existed three kinds of "partridges," tinamous: guayco, the big ones; picasa (probably a mis-spelling of pisaca), the medium-sized ones; and yuyo, the small ones (Rostworowski de Diez Canseco 1981: 61). Vázquez de Espinoza mentions them for the coast; but in 1982 in Ocros I observed small tinamous kept in houses in a semi-domesticated state, a fact that demonstrates their existence in the highlands.

But who was Mama Rayguana? The myth says that she lived elsewhere, in a village called Caina, probably further up into the mountains. The modern version of the myth of Tumayricapa mentions that the people north of Lake Junín (Chinchaycocha) worshipped Rayguana as their goddess, at a time when there was still enough water to cultivate lands. She lived in a place called Atojhuarco ("the hanged fox"). The myth explains how two eagles came down out of the sky and how Rayguana advised Tumayricapa about the meaning of

the prognistication. As a result, the people of the Wankas, living in the highlands, defeated those of the Waynas, obliging them to retreat to warmer and lower valleys. We can possibly identify Rayguana, as a huaca, with the place where Tumayricapa in the older myth came down to earth: Mamallqui jirca, the "plant or beginning or origin of the mountains." The reference here to Mallqui as "plant of origin" may have been similar to that of Mama Rayguana in the myth from Hacas as the original female owner of cultivated plants. But even if we discount a direct identification of Mamallqui jirca with (Mama) Rayguana, the sequential place of both is similar in the three myths. They precede either Tumayricapa, the Thunder god, in the myth from Chinchaycocha; or the eagle (one form of the Thunder god) in the myth from Hacas; or Tumayricapa and the eagles together in the modern myth.

The two older myths seem to have a similar calendrical reference and purpose. Before arguing this, I shall have to mention some transformations between the two myths. Tumayricapa acts in the myth from Chinchaycocha as a Thundergod, a god who in other myths from Central Peru came down to earth as an eagle. If we compare him to the eagle in the myth from Hacas, then it becomes an obstacle to comparison that in Chinchaycocha the yutu bird is a foster mother of the eagle (i.e. Tumayricapa), but in Hacas his male collaborator. However, while in Chinchaycocha the yutu is a secondary mother to the eagle, in Hacas the yutu is the effective secondary bestower of cultivated plants to the people there. Thus, in Chinchaycocha Tumayricapa has an intermediary role between the two mothers, on the one hand, and the people who worshipped them, on the other; in Hacas, the eagle had an intermediary role between the two bestowers of plants. In terms of the calendar, the role of the Yutu (in Hacas called yucyuc) probably remains the same in the two myths. The question, therefore, becomes: can the ritual and mythic significance of the Yutu bird in these two myths refer to the Yutu constellation; to the constellation which has its period of upper culmination around 25 March?

With this question in mind, we are now in a position to discuss the four calendrical references in the myth from Hacas as they had been mentioned before:

1) The plowing

Guaman Poma, in his calendar, mentions, on the one hand, that plowing of fallow lands was done in March; on the other hand, the King in Cuzco would carry out a ritual plowing in May as well as in August. At the moment our information on the agricultural calendar of modern highland villages overlooking the coast, like Ocros and Hacas, is still too scanty to draw specific conclusions. There seem to exist, however, some remarkable differences between this region and Ayacucho and Cuzco, from which latter places most of our information derives. Therefore, I shall base my calendrical argument for Hacas more on the following data.

2) The rains in Ocros and Hacas stop in about April. My ethnographic information and that of Huertas indicate that then it is time to repair the irrigation canals (Huertas 1981: 54).

3) Easter, as a movable feast, can fall on a day from 22 March to 25 April.

4) The time of the feast of the yucyuc bird fell on a day within this period from 22 March to 25 April. Other data on the dances aylli aylli, ayrihua and that of the Pallas with their drums support the choice of this period. Data on the Inca calendar (e.g. Cobo 1956: 214) indicate that the names of Ayrihua and aymoray were applied to the eleventh and twelfth synodic lunar months respectively. Their average place in the calendar is from 28 March to 25 May, but Ayrihua could start as early as 13 March and as late as 10 April. If we take into consideration the indications of Polo de Ondegardo and Molina concerning the 12 months of the solar year calendar, then we are dealing with the period from 21 March to 21 May. It is of further interest to recall that in the average synodic lunar calendar the new moon separating the months of Ayrihua and Aymoray coincided with the passage of the sun through the nadir, when the sun is setting at the antizenith point, that is on 25 April. In Ocros and Hacas, this passage occurs 6 days earlier, on 19 April.

In these villages, as in Cuzco, the name of ayrihua was applied to the kinds of maize cobs that were considered as twins, cobs having grains of two different colours. These were not eaten or used for making beer, but burned on the fields as a sacrifice to the new crops at the time of early harvest in April. Another name of twin cobs was chuchu, a name given also to human twins and to two small stars said to be close to the Pleiades. This information would mean that the twin stars disappeared around the same time as the Pleiades, these latter disappearing from ± 15 April to ± 8 June. We can conclude that the month of Ayrihua was tied to the time of the disappearance of the twin stars. Although in Cuzco the name ayrihua is given normally to the eleventh month (either the synodic lunar or the solar month) as a reference to the ritual of ayrihua, the ritual itself could be celebrated also in the twelfth month (Guaman Poma 1980: 245/247; Molina 1943: 66). Probably we have to interpret ayrihua in general as an agricultural ritual celebrating the harvest during the last two months of the solar year count, that is during the time when the twin stars disappear.

We arrive at similar calendrical results by analyzing the name aylli aylli. Aylli means "victory song," also used in the combination aucaylli (auca, "warrior, enemy"; aylli, "victory song"). It was used in war, as well as during planting and harvest in agricultural rituals. The panaca associated in Cuzco with III 2, representing the eleventh period in the 328-night count (17 March to 9 April), was called Aucaylli panaca. This panaca held land among the settlements of the non-royal, and probably pre-Inca, ayllus of Sañu, related also to III 2, and of Yacanora, Ayarmaca and Cari, belonging respectively to III 3 a, III 3 b and III 3 c. These last ceques together represented the twelfth period in the 328-night count (10 April - 3 May).

Ceque III 3 a contained as its first huaca a plain, a cultivated field, called Ayllipampa ("the plain aylli"), of which "people said that it was the goddess earth called Pachamama ('mother

earth'), and they offered her small female dresses." The three ceques were very close to the same direction, succeeding each other out from Cuzco and pointing to the zenith sunrise as seen from the Temple of the Sun. This direction had been used in 1535 at some date in the month of April (Julian calendar), that is between 11 April and 11 May (Gregorian calendar), for one of the last Inca rituals carried out with full pre-Spanish pomp (Cristobal de Molina, el Almagrista 1967: 81-83). The main event was a procession celebrating the bringing in of the harvest. Cobo described such a feast in more general terms occurring at the beginning of the month of Aymoray; that is, in terms of the average synodic lunar calendar, a date just after that of antizenith sunset, 25 April. The use in this context of the names Aucaylli and Ayllipampa confirms their calendrical importance, being related to the periods of III 2 and III 3 (17 March - 3 May), overlapping with the months of Ayrihua and Aymoray (Ayrihua having its earliest possible beginning date on March 11), and overlapping also with the eleventh and twelfth solar months dedicated to the Thunder god (21 March - 21 May).

The calendrical arguments given here, make it completely plausible to arrive at the following conclusions:

1) The author of the document on Hacas was right in assigning a time to the ritual of the yucyuc bird corresponding to the eleventh solar month, the month after the March equinox.

2) The ritual reflected the upper culmination of the constellation of the Yutu in the Southern Cross.

3) The male yucyuc bird of the ritual and the yutu-mother of the myth of Chinchaycocha probably had the same calendrical significance.

4) The reference to the Ayrihua and the Aylli aylli dances extended the correspondence with the Inca calendar to the whole period when the Pleiades and the Twin stars disappeared and when the eleventh and twelfth solar months were dedicated to the Thunder god.

5) The eleventh and twelfth periods of the 328-night count corresponded to the beginning of the period mentioned in 4).

Mama Rayguana and the Thunder

Having made specific suggestions about the calendrical questions, I can now come to a more general discussion of the calendrical importance of the Thunder god in his relation to the female goddess who was the origin of the cultivated plants. The first question is: who was Mama Rayguana and can we give her a more precise astronomical and calendrical identification.

Mama Rayguana and Mamallqui jirca apparently had a place in the calendar related to an earlier date than either the celestial black Llama or the celestial Yutu. While the Llama gave men wool of

different colors, but no plants, the Yutu had an intermediary function between Mama Rayguana and men in terms of plants and also between Mamallqui jirca as the "plant of origin" and the Thunder god to whom the llamas with wool of different colors were sacrificed. Although I do not have any direct evidence for the suggestion I want to make, I suspect that Mama Rayguana and Mamallqui jirca both might have a symbolic association with the toad, and that their celestial correspondence was with the black-cloud constellation of Hampatu, the "Toad." This constellation is mentioned in Cuzco today, being found just before (to the west of) the Yutu in the Milky Way (Urton 1981a, 1981b: 180-85). Its period of lower culmination is just before the September equinox and that of its upper culmination just before the March equinox; that is, respectively, in the fourth and tenth solar months, when in the first month 100 black llamas and in the second 100 white llamas were sacrificed. The toad is identified in Mochica art as giver of plants (Mariscotti 1978). Further iconographic research might possibly suggest a relationship between its symbolic place there and in Brazilian myths of the toad as mother of twins and as wife of the jaguar. In Mochica art, one sees the animal either in a situation of coitus involving a male jaguar and a female toad or one of two toads (Mariscotti 1978). Today, in Cuzco, the toad is very much identified with the rainy season, coming out of the cracks of the earth in September and returning at the end of the rainy season (Urton 1981b). In October the male toad is especially aggressive sexually (Roca 1966), but otherwise the toad has an eminently female role. Mariscotti has studied her identification with Pachamama, "mother earth." In various places of Southern Peru the toad is said to live in wet caves or under waterfalls, changing at night into a beautiful woman, a siren, to whom men come "to have their guitars tuned." In the last case, then, the physical change of the toad is not seasonal, but daily. The myth of Huatyacuri in Huarochiri (Avila: ch. 5)-- where the central deity discussed is the Thunder god-- gives a crucial role to the toad. Further research into Peruvian mythology may suggest, therefore, the toad's importance in the calendar.

The possible significance of Mama Rayguana and of Mamallqui jirca as the toad in its importance for agriculture may help to understand further the rituals of the fourth synodic lunar month (September) and the tenth (March) in their calendrical opposition. The first, as the month of planting, was called Coyaraymi, the feast of the queen, when women would invite men. Evil and illness were expelled from the town, houses were cleaned and people would invite each other. Expelling evil was done by warriors, brandishing torches and running out of town, following the 41 directions of the ceque system (Zuidema 1982c). The average position in the calendar of Coya raymi means that a full moon fell on 17 September, 4 days before the September equinox. The earliest possible date of a new moon in this month was 19 August, the time when the sun went through the central pillars, erected on mountain Picchu for observing the antizenith sunset (that is, in the 328-night count, after II b). The lunar month of Coyaraymi, then, was correlated to the solar month before the September equinox (the fourth), when white llamas were sacrificed to the sun, and when priests of the sun, called Tarpuntay, started their

fasting, accompanying the germination and first growth of the maize plants.

We observe a clear opposition between Coyaraymi and the time of the year including the tenth solar month, as well as the tenth synodic lunar month called Pachapucuy and the tenth period in the 328-night count (III 1, from 14 February to 17 March). The dates of 14 February and 17 March correspond closely to the passage of the sun through the zenith (13 February) and the equinox (21 March). The name of the tenth month Pachapucuy (pacha, "earth," pucuy, "rainy season, that of the ripening crops") probably refers to the fact that at that time the king would address himself to the huacas, the sacred places of the earth, in order to consult them about the past, the future and distant places. The king, in his capacity as consultant, was called Viracocha Inca. He identified himself with the ancestor priest-king of this name. Guaman Poma (1980: 261-62/263-64), in a drawing of the event, clearly refers to the ceque system, indicating his awareness of its importance. He does not give the drawing in the context of his description of the months, but in that of his description of the large temples and the state ritu als of Cuzco. The description corresponds, however, to the one of Pachapucuy, when the high priest, as descendant of Viracocha Inca, carried out the consultation of the huacas. The ceque system is referred to in two months, Coyaraymi and Pachapucuy, half a year apart from each other. Coyaraymi combines the elements of female month and that of sacrifices of white llamas to the male Sun god. We may ask, therefore, whether Pachapucuy did not combine similar elements in a corresponding way; if this month, when male rituals were carried out by high priests for the huacas of the ceque system, was not dedicated also to female deities like Mama Rayguana and Mamallqui jirca.

The suggestions made here may gain in strength if we see them in the context, not only of the opposition between the fourth and the tenth solar months, but also in that between the third and fourth months together and the ninth and tenth months together. The synodic months of Tarpuy quilla (3rd) and Coya rami (4th) formed a group in the sense that they were both concerned with planting (tarpuy). The dictionary of González Holguín gives them similar names, respectively: Kapak Sithua, "royal situa" and Antta cittua. (He calls them August and July, respectively, but we have to identify them as September and August). The name situa is probably derived from an Aymara word (Bertonio): satav or sita, being the root of verbs referring to planting, like Tarpu in Quechua. The ayllu of the priests Tarpuntay belonged in the ceque system, however, to III 1; together with Sucsu panaca, the panaca of Viracocha Inca and of the high priests. The tenth period in the 328-night count (III 1, 14 February - 17 March) together with the ninth period (I 1, 22 January - 13 February) corresponded to the tenth and ninth synodic lunar months that had the name -pucuy in common: respectively Pachapucuy and Hatunpucuy (hatun, "large"). Thus, the two months of planting (tarpuy) were opposed to the two months of ripening harvest (pucuy). While the priests of Tarpuntay acted in the first two months, they belonged, in terms of the ceque system, to a period related to the other two. Still today, the mother earth, Pachamama, is said to "open up" in

the months of August and February. It was probably in the time of the year before the March equinox that Mama Rayguana was robbed of her gift to humanity of cultivated plants, an act in which the Thunder god played an active role and that was celebrated in the month after the equinox.

With this calendrical understanding, we can venture now a hypothesis of why, in the Inca calendar, one hundred llamas were sacrificed to the Thunder god in each of the months Ayrihua and Aymoray. Ayrihua was associated with twins; that is twins of maize, animals and people, considered as being conceived by the Thunder god. Twin children were dedicated to the Thunder god, one was sacrificed, and seeds called ayrihua were burned as an offering to him. The months of Ayrihua and Aymoray were the months of games, when the Inca king would enter into the binary relation of a game of chance with people who otherwise were his inferiors. Finally, Ayrihua and Aymoray represented the time when the Pleiades and the Twin stars were in the Underworld. The heroic time of the Thunder god, mentioned not only in the myth of Chinchaycocha but in many other myths from Central Peru, dealt with the period when the Twin stars represented him in the Underworld. A myth from Northern Central Peru, Huamachuco, about the Thunder god as a twin brother (Agustinos 1952) is very similar to the myth of the twins in the Underworld of the Popol Vuh in Guatemala. It lacks the element of the competitive games that the twins play in the Underworld there; but this element is not lost in the myth of Huatyacuri from Huarochiri. This is another version of the theme of the heroic Thunder god. The actions of the Thunder god accompany two calendrical events: that of the passage of the Twin stars through the Underworld and that of the moment when the Sun passes through the nadir. The Thunder god was reborn and grew up in five days around the latter event, but his heroic actions in the myth of Chinchaycocha extended over a longer period. It was at that time that the Thunder god changed the crops of the year that was ending into the seeds of the year to come.

The integration of the three calendrical counts

The mythological and astronomical information from Chinchaycocha and Hacas helped to understand calendrical problems in the period of the year from 14 February to 23 May and they concerned not only this region of Peru but also that of the Incas in Cuzco. I have tried to understand in Cuzco data referring to the synodic lunar calendar and to the 328-night count in terms of the solar year with months of 30 or 31 days and with seasons that each started with the month before a solstice or an equinox. The comparison that I carried out of the three calendrical counts can lead us now to suggest an integration closer than I hitherto suspected.

Aveni's and my research into astronomy in Cuzco revealed that the Incas had a specific interest in observing the sun in terms of the solstices, of a date 30 days before the June solstice and of the dates of the zenith sunrise and the antizenith sunset. The integration of the average synodic lunar calendar and of the 328-

Table 5 The correspondence between the three calendrical counts

	Months of solar year count (estimated dates)	Average synodic lunar months (these months can occur 15 days earlier or later)	328 night count (dates in II and IV indicate night before; those in I and III indicate night after)	
1)	22 May - 21 June (guanacos)	6 June - 4 July Intiraymi taking maize kernels from cob.	II 3 9 June - 5 July	3rd king
2)	22 June - 21 July (guanacos)	Chahuahuay quilla 5 July - 3 August (irrigation)	II 3 6 July - 4 Aug.	5th king
3)	22 July - 20 Aug. (guanacos)	Tarpuy quilla 4 Aug. - 1 Sept. (early planting)	II 1 5 Aug. - 2 Sept.	4th king
4)	21 Aug. - 20 Sept. (white llamas)	Co ya raymi 2 Sept. - 1 Oct. (planting)	IV_B 3 b, 2 3 Sept. - 30 Sept.	Queen, women
5)	21 Sept. - 20 Oct. (white llamas)	Uma raymi 2 Oct. - 30 Oct. (expecting rains)	IV_B 1, IV_A 1 1 Oct. - 30 Oct.	Uma
6)	21 Oct. - 19 Nov. (white llamas)	Ayarmaca raymi 31 Nov. - 29 Nov. (expecting rains)	IV_A 2, 1 1 Nov. - 21 Nov.	Ayarmaca
7)	20 Nov. - 20 Dec. (guanacos)	Capac raymi 30 Nov. - 28 Dec. (rains, initiation)	I 1 21 Nov. - 23 Dec.	10th king
8)	21 Dec. - 19 Jan. (guanacos)	Capac raymi Camay quilla 29 Dec. - 27 Jan. (rains)	I 2 24 Dec. - 21 Jan.	9th king
9)	20 Jan. - 18 Feb. (guanacos)	Hatunpucuy quilla 28 Jan. - 25 Feb. (rains)	I 3 22 Jan. - 13 Feb.	6th king
10)	19 Feb. - 20 March (black llamas)	Pachapucuy quilla 26 Feb. - 27 March (rebuilding lakes)	III 1 14 Feb. - 16 March	8th king
11)	21 March - 19 April (llamas different colors)	Inca raymi, Ayrihua q. 28 March - 25 April (rebuilding irr. canals)	III 2 17 March - 9 April	7th king
12)	20 April - 21 May (llamas different colors)	Aymoray quilla 26 April - 25 May (harvest from Ayrihua on)	III 3 10 April - 3 May	

night count-- the latter based on a sidereal lunar calendar-- into the solar year add to those interests those of a date 30 days before the December solstice (IV A 1a, 21 November), of a month-long period around the antizenith sunset in August (II 1, 5 August - 2 September) and of the commencing date of a month-long period around the antizenith sunset in April (III 3 a, 10 April). Furthermore, the 328-night count seems to be more interested in the exact dates of the zenith passages (IV A 3 a, c, 30 October; and III 1 a, 1 February) than in those of the antizenith passages. Although we do not have any specific information about an interest in the equinoxes, my discussion of the llama sacrifices seemed to reveal such an interest. This interest might be supported by the following dates in the 328-night count.

IV B 3b, 17 September and III 2a, 17 March both occur four days before an equinox. The dates indicate that the Incas in fact might have been interested in observing equinoxes (see Note 3), although in a way that led to a discrepancy of four days in relation to the exact observation of the equinoxes. If we take the two dates of 17 September and 17 March into account calendrically, we might arrive at a reformulation of the system of llama sacrifices (one hundred llamas each month) in honor of the three gods, Viracocha, the Sun and the Thunder.

The period from 23 May-- a date recognized by an observation from the Temple of the Sun, although not in the 328-night count-- to 17 September (IV B 3 b) framed the time within which thefirst three months of the synodic lunar calendar could move from their earliest to their latest occurrence in the solar year. The whole period covers 117 days. A similar argument can be made for the third season of the synodic lunar calendar, accepting that the time of I (85 nights) together with that of III 1 (31 nights) in the 328-night count framed those three synodic months. This whole period was of a length similar to that of the first period mentioned. This reasoning concerning the two periods of 117 and 116 nights would lead to the conclusion that the first and the third seasons of the solar year were related more specifically to an interest in observing synodic lunar months, induced by the obligation of celebrating the solstices in terms of full and new moons.

In the articles previously mentioned (Zuidema 1982a, 1982b), I arrived at the conclusion that the foremost interest during the second season of the solar year was in defining a sidereal lunar count in terms of precise astronomical observation. The periods of IV B 2 and IV B 1 together divide the period of one sidereal lunar month of 28 nights in the regular way of 4, 4, 5, 5, 5, 5 nights. The constellations of Yutu and Llampa ñawin (Southern Cross and Alpha and Beta Centauri) have, as a group, their lower culmination during this time (18 September - 15 October). We observe on both sides of this period the half-month periods of IV B 3b (15 nights, 3 September - 17 September) and of IV A 3 a, c(15 nights, 16 October - 30 October); periods that might have helped to correlate the observation of the moon with that of the group of the two constellations. During this period of the year (IV, 3 September - 21 November), the data support an argument for the

female associations in terms of stars (Southern Cross, Alpha and Beta Centauri and the Pleiades), as argued previously.

The calendrical suggestions, presented here for the seasons II, I and IV leave us with the final question concerning the practical astronomical observations carried out in season III (14 February - 3 May) and the time not covered by the 328-night count (4 May - 8 June). I arrived at the conclusion that, in terms of its constellations, this season was concerned especially with the upper culmination of the Southern Cross (Yutu) first, followed by the lower culminations of the Pleiades and the Twin stars. The central concern during this season was, however, the Thunder god. We are faced, therefore, with the question: can we assign to this god a precise astronomical-calendrical association in a way similar to that of the other seasons? One association that I determined was with the antizenith sunset. But this date is not the same on the various latitudes in the Andes (25 April for Cuzco; 19 April for Chinchaycocha and Hacas). The Thunder god, the Twin stars and the Pleiades were closely associated by Andean peoples with Venus as the morning and evening star. In a future article, I shall explore the significance of Venus in Andean astronomy and Andean calendars. I have to limit myself here to the suggestion that the time from the March equinox and heliacal set in the evening of the Pleiades and the Twin stars to the time of 23 May (being 30 days before the June solstice) and heliacal rise in the morning of the Pleiades was important especially for the inclusion of Venus in calendrical considerations.

The calendrical dates presented in this final section reveal an adaptation of the solar year count to those of the synodic lunar count. The following periods, belonging to the solar year count, were included in the calculations of the 328-night count: I 1 (33 nights) and I 2 (29 nights); II 1 (29 nights), II 2 (30 nights) and II 3 (26 nights; that is a synodic month minus the nights of the new moon that in this case were included in the period of the year not covered by the 328-night count). While Polo de Ondegardo referred in general terms to months of 30 and 31 days, the seasons of I and II, each with 85 nights in the 328-night count, adapted those concerns to other calendrical considerations, adaptations further accomplished with the help of III 1, 31 nights, and IV B 3 b, 15 nights. It was the seasons of IV and III in the 328-night count that expressed the interest in observing the stars and, possibly, Venus.

Notes

1 For an explanation of the periods in the 328-night calendar, see pp. 245-46. The period of upper culmination indicates the period when a star is seen during the whole night from the moment of its heliacal rise to its moment of heliacal set at sunrise. The period of lower culmination and of its invisibility extends from the moment of heliacal set in the evening to that of its heliacal rise in the morning. The constellations of the Southern Cross and of Alpha and Beta Centauri, because of their relative proximity to the

south celestial pole, are defined as quasi-circumpolar. They never disappear from the sky during the whole night. They can be seen, at the latitude of Cuzco, and during their period of lower culmination, to have their heliacal set at the beginning of the night and their heliacal rise, during the same night, just before sunrise. While the Pleiades are invisible during the whole night for about 50 nights, the quasi-circumpolar stars are invisible for only part of the night for about 25 nights in each case.

2 In 1980, A.F. Aveni and I made two types of measurement concerning the direction of the Temple of the Sun in Cuzco facing sunrise. The first consisted of the perpendicaular of the front wall belonging to rooms A and B; the second of the center line in between both rooms. The first gave a reading of sunrise 27 days before and after the June solstice; the second of 30 days before and after the June solstice. The first reading favors an attention to the earliest possible date for a new moon of the month including the June solstice; the second reading favors a date of interest for the solar year count as discussed here. The discrepancy between both readings consists of only some 15′ of arc.

3 An Inca interest in observing the equinoxes is supported by the measurements that Aveni and I carried out in Huanucopampa in 1980.

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APPENDIX

Reconstruction and transcription of Madrid pp. 77-78
by M.Z. Alvarado.